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How Will Manufacturers Hold Home Market?

Problem Presented by the New Tariff Law Discussed by Leaders of the Iron Trade and Builders of Machinery—Widely Different Views Presented

A new tariff law, which will remain on the statute books for at least four years, brings squarely before the manufacturers of the United States the question, "What are you going to do about it?" It is not merely a question of what can be done to enable the United States to extend its foreign commerce; it is question of how the manufacturers will hold their home market in competition with the countries of the world.

In order to obtain expressions of opinion on this subject from practical men of affairs, THE IRON TRADE REVIEW *recently addressed a letter of inquiry to some of the prominent manufacturers of the country and others whose experience qualifies them to speak. The object was particularly to obtain views on the following:*

Would you reduce costs by lowering the quality of the product, by reducing wages, or by introducing new methods of manufacture?

If you favor the last named plan, will you present some suggestions as to how labor-saving devices can be utilized, how waste of material can be reduced and how the energy and ability of the workingman can be used to the fullest extent?

We should like to know how you would encourage greater loyalty to their employers among the employes.

Some of the leading manufacturers of the country for various reasons have asked to be excused from discussing at this time the effects of the tariff; but replies from manufacturers of iron and steel products and machinery, representing a wide range of output and a large amount of capital, have been received and are extremely interesting. These letters are as follows:

Adopt Co-operation Under Governmental Control

In my opinion, the future of American industry is more dependent upon constructive legislation than it is upon economic questions of management. Therefore, as a first step to squaring ourselves to new conditions of competition, we must have the support of a public sentiment that will demand legislative reforms and wipe out demagogism in politics. I would suggest, as amendment to the Sherman anti-trust law that would legalize trade arrangements to be subject to strict governmental regulation, so that the public interest would be fully protected against either unfair methods or extortionate prices, and thus conserve not only invested capital, but our natural resources, and furthermore, make possible a standard of wages that could not be maintained under destructive competitive conditions. In general, reverse the present governmental attitude of antagonism to one of co-operation. Co-operation between the government and business, as is well known, has made Germany the commercial wonder of the world, and the German policy, if applied at home, would do much to insure business, or put the wheels of industry in motion. In placing legislative reforms ahead of reforms in manufacturing methods, or reductions in costs, it is in recognition of the fact that the greatest economies cannot be obtained in manufacturing, if operations are to be restricted or limited to small units, or if destructive competition cannot be avoided by co-operative effort. The energy, ability and courage of the American business man require no defense at my hands, and no better illustration of the advantages of concentration or integration could be selected than the United States Steel Corporation, whose wonderful development and growth have set a pace in progressive methods of management that has had a vitalizing influence on the iron and steel industry, and as a result, we are obtaining a large share of the world's trade. Why not, in the light of this experience, accept the fact that big business is necessary to our larger success, and work out a program of co-operation under governmental control? It is generally recognized, however, that business success in the manufacture of steel, as in other lines, is dependent largely upon intelligent and careful management, and that studious attention must be given to such economic questions as labor costs, labor-saving devices, fuel economy, waste and by-product recoveries and general business efficiency, but at the same time, it must be recognized that ill-advised legislation will not only hurt, but even destroy, the best managed industry. Charges of lack of diligence to matters of this kind cannot be maintained against American manufacturers; on the contrary, our mechanical devices and metallurgical practice challenge comparison. It is possibly true, however, that Germany has made more progress than we, as a nation, in the refinements of waste products, but with an increasing cost for fuel and other materials, more profitable opportunity now offers at home for capital

JNO. A. TOPPING

investment in devices suggesting economic refinement, and in recent years large sums have been expended in this direction.

American manufacturers are also keenly alive to the necessity of paying more attention to the human side of labor problems, and here, too, progress has been made in the conservation of life and health by creating better conditions under which labor is employed, greater safety, better sanitary regulations and housing conditions to conserve the health and comfort of the worker. Much is also being accomplished educationally, through factory training and by encouraging greater interest in profits and losses, by means of profit sharing, and in stimulating thrift by home building.

So far as operations may be affected by foreign competition, no reduction in quality, in my opinion, will result; the American manufacturer, on the contrary, I think, will strive to improve quality, and, of course, efforts will be made to reduce costs in every way possible through the continued operation of economic methods; reductions in wages may come, but only as a war measure and as a last resort.

Opinion is divided as to what will be the full effect of the reduction in duty on imports, but the fear of foreign competition, unquestionably, has stimulated liquidation by consumers and has intensified the stagnation in business. I believe, however, that the readjustment is well on towards completion and that the time is near at hand when the consumers of steel must realize that values are close to a basis where the operation of replenishing stocks of iron and steel is reasonably safe against shrinkage. At all events, present values cannot be reduced materially without involving the liquidation of labor or the elimination of *all* profits.

JNO. A. TOPPING.

Republic Iron & Steel Co.,
New York.

Better Sense of Social Responsibility Demanded

Generally speaking, the manufacturers of this country should look to a possible revision of methods of manufacture in coming years. Doubtless in many industries to attempt to do this may seem hopeless, but, taking industry in general, a searching review and re-consideration of methods now in vogue will doubtless produce many economies. These economies may be achieved either by the introduction of better machinery or by better ways of handling labor itself. We are of the opinion that a great deal can be done along this latter line by the introduction of a better element of foremanship. The good foreman or good superintendent is not necessarily a good workman. He should be a man who is skilled in leading men to loyalty and efficiently cooperate with the management. Too often the foremanship is grossly culpable in the mismanagement of industries. Manufacturers who pay the greatest attention to their financial reputation and the management of their salesmen's department, are very weak in the management of their help, and largely because of inattention to the element of foremanship. Not only should the best of men be secured for this position, but it should be understood that every workingman has an appeal above the foreman to the management itself. In this way, we believe, a sense of justice can be conserved and better co-operation secured.

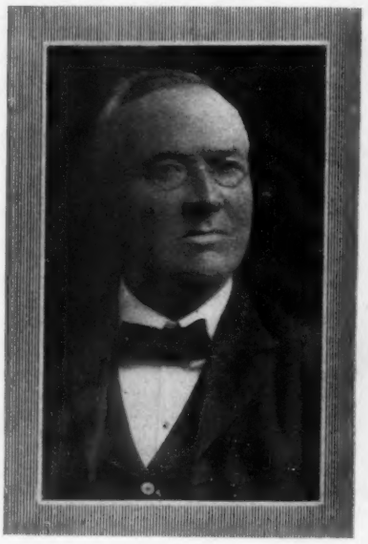
In a larger sense, we are of the belief that manufacturers can well develop a larger sense of social responsibility in employing help and managing their industries. Can our big corporations, which dominate villages and towns, be said to cultivate community life as they should do? Is not the case of Lawrence one like absentee landlordism? And are there not too many Lawrences in our land? A better sense of social responsibility will mean better co-operation in future years of increasing competition. And better co-operation we must have.

As to lowering quality of the product in order to meet competition, this, to my mind, is unthinkable; and as to reducing wages, this will be regulated by time itself in natural ways. If there is to be a period of depression in this country, naturally a great many men will be thrown out of work. When they are re-hired, it will be at market rates. Notwithstanding the claims of some of our modern financiers, the rules of supply and demand will rule in the future as they have in the past.

HENRY D. SHARPE.

Brown & Sharpe Mfg. Co.,
Providence, R. I.

Cheap Goods Mean Low Wages



THOMAS DEVLIN

Replying to your circular inquiry relative to the effect of the tariff on our business, would say it will have no direct effect whatever, as we have a good market for our goods abroad and were getting better prices than for goods sold at home, until our domestic competitors made lower prices, which we naturally had to meet.

We would very seriously object to lowering the standard of quality; on the contrary, we favor raising the standard of quality to the top notch whenever possible, which, we believe, would tend to give the domestic goods the preference over the imported.

We very strongly oppose the reduction in wages, although we are in favor of using any and all labor-saving devices and guarding very closely against waste from every source. The best way to secure loyalty from employes is to treat them fairly under adverse business conditions and not wait until business is booming to recognize their rights. The time is past when people can live on any lower wages than paid at the present time. We think loyalty can best be secured by kind, humane consideration and brotherly treatment of our workmen, because we are all workmen despite the fact that some positions carry a title with them, although the holders often work as hard as those in menial positions and often with but poor returns for their labor.

We are very sanguine that times will change when the government will permit the railroad companies to earn a living and cease interfering with legitimate business for political purposes.

The tariff will indirectly affect us by lowering the price

of goods that require a protective tariff in order to pay American wages and produce them at a profit, and we think it a fatal policy to admit goods free of duty that can be made at home, providing there is a duty on the same goods if imported.

The theory of low tariff is intended to furnish cheap goods, and cheap goods must surely mean cheap wages, or, if not cheap wages, it must mean manufacture abroad, and on all such manufactures must mean no wages paid for them in this country; and, without work, where will the money come from to buy the goods, even though they be cheap? Bargains or job lots must mean cheap labor. We saw that condition before and think we see it coming now—in fact, it is here already.

The only way to get matters working on a correct principle is to send hot air artists to the rear and place in charge of government affairs men of business, who are not trimmers, but work to a successful conclusion whatever they attempt or undertake to do.

THOMAS DEVLIN.

Thos. Devlin Mfg. Co.,
Philadelphia.

Tendency Toward Elimination of Small Producer

WILLIAM A. ROGERS

Responding to the questions outlined in your favor of the 17th, as to whether the more active foreign competition which free trade forebodes could be best met through lower costs produced by lowering the quality of the product or by reducing wages or by introducing new methods of manufacture, my views are as follows:

It is impossible to lower the quality of pig iron. It is a standard material, resultant from the smelting of iron ores, and, as it costs more to make pig iron from a poor quality of ore than from a high quality, there is no chance there for a reduction in cost.

Reducing wages would not accomplish the result, as it would not be possible to reduce to a parity with those in iron manufacturing districts abroad.

The only way open is, therefore, by introducing new methods of manufacture. This, however, involves destruction of capital on a large scale, with resultant hardship to a large number of people, mostly of moderate means, whose savings and inheritances are in the stock of these older companies, upon which their living is more or less dependent.

The natural operation of conditions produced by this law is to drive the business into the hands of the bigger fellows, concentrating it in fewer, but very much larger corporations, and also to eliminate a large army of workingmen who would be replaced by labor-saving devices. In other words, the only way of reducing the cost of pig iron is to replace labor with those mechanical and electrical appliances which permit one man to do the work of twenty or forty, as now employed in a large percentage of the blast furnaces of this and other countries.

This involves the abandonment or wrecking of a large number of the older institutions, the plants of which are not adapted to the application of these improvements. The new institutions which take their place must be those having large aggregations of capital to make possible the expenditure necessary not only for these labor-saving devices, but to include the further economy of being self-contained in the matter of ore and coal mines, coke ovens and other supplies.

The tendency of free trade is toward the elimination of the smaller producer of pig iron and steel.

WILLIAM A. ROGERS.

Rogers, Brown & Co.,
Buffalo.

Introduction of Special Machinery

The first thing to do is to inquire into possible new methods of manufacture and the reduction of costs by more economical methods or special machinery designed for the purpose intended.

If it becomes absolutely necessary, the second thing to do would be a possible reduction of wages, but this is always a very problematical question, as the modern manufacturer is beginning to learn that one higher priced man with up-to-date methods is more profitable than several low priced men without such methods.

We would not care to go on record as regards the labor question, as in our own factory we believe in paying the highest possible wages and obtaining the best skilled labor.

The last thing for any manufacturer to consider would be the lowering of the quality of product turned out, as we believe that any saving which can be obtained in this manner is only represented by a temporary gain, as the loss in trade and the greater expense of selling a poor product very soon counteracts the lowered cost of production.

To your fourth question as regards labor-saving devices, would state that to our mind the highest saving is probably in the handling, and the way to tackle this proposition is along the lines ordinarily talked of as scientific management, *i. e.*, planning out a routine along which the work proceeds, so that from raw material to finished product there is as little delay and friction as possible. This planning is naturally up to the management, and not to the workman.

The workman reaches his fullest development when his efforts are guided by instructions which have been tested out, and according to methods which have been proven scientifically correct.

Again, the question of proper machinery or special machinery is one of greatest importance, as there are many factories today producing goods with four, five or more handlings, when an automatic machine would produce the same goods by handling once.

Regarding your fifth question, loyalty of employes, would state that our own experience has proven very satisfactory along the lines of planning for the workman so that he can obtain the maximum of efficiency, and then paying him a proper price for such efficiency. Also we have the one boss system in our factory which prevents a multiplicity of orders.

Each workman knows that he is responsible to the head of his particular department, and no one else has any authority over him. An order from even the general manager would be given through the head of his department, and the head of each department is held strictly accountable for the work which he is supposed to have charge of.

Also, anyone in the shop has the privilege of bringing

up any question or grievance direct to the highest authority, and if he has any suggestion for betterment, he is given full credit for it.

E. R. MINER.

The Baird Machine Co.,
Bridgeport, Conn.

Reduction of Cost Means Lower Wages

We could not lower the quality of our product; but must continue, as in the past, to raise it. Some very good machines are made in some foreign countries; and in order to compete with these foreign machines, as well as with those made in this country, we must keep our quality up.

As to introducing new methods of manufacturing, we do not think this could be done in the machine tool business to any greater extent than it would naturally be done under normal conditions. We have striven in the past, and we shall continue in the future to strive to produce our goods by the least expensive method; and we believe that any extra efforts we make along this line, will partially balance the effect of the lower tariff.

Therefore, by the process of elimination, we come to the following conclusion:

That the reduction of cost, which is necessitated by the lower tariff, would be obtained by the reducing of wages.

E. M. WOODWARD, *Pres. and Treas.*

Woodward & Powell Planer Co.,
Worcester, Mass.

Furnaces Will Await Industrial Recovery

D. B. MEACHAM

We are interested in the production of pig iron and would not consider lowering the quality, because it is a principle of our business to manufacture the highest possible grade.

It does not seem wise or practicable at present to reduce wages, and I do not know of any new methods of manufacturing pig iron that will reduce the cost. Apparently blast furnaces will be continued in operation until the lack of demand forces them to shut down, and they will remain closed until the country has recovered from the effects of recent and pending legislation, or until new legislation is enacted that will inspire confidence in the manufacturing interests of the country.

Notwithstanding the unwillingness of consumers to purchase now for delivery during the first half of 1914, there is much encouragement for the future in the fact that stocks of iron at furnaces and in foundry yards are very low, and shipments on existing orders are taking current output. It is supposed that this year's crops are of as large money value as were those of 1912, and the basic conditions of the country are sound.

D. B. MEACHAM.

Rogers, Brown & Co.,
Cincinnati.

Lower Wages May Be Necessary

A. F. HUSTON

Yours of the 18th received. In reply to the same would say we would not attempt to reduce costs by lowering the quality of our product. If prices get too low for us to get out whole, we shall undoubtedly have to reduce wages, and also endeavor, wherever possible, to reduce our labor cost by putting in such additional labor-saving appliances as may be available.

As to a new method of manufacture, that is a pretty vague thing, and we should not attempt to make any radical departure in that line without at least trying it out experimentally for some time. Many electrical appliances have been used during recent years, which have done away with a lot of hand labor, and probably more still will become available.

A. F. HUSTON.

Lukens Iron & Steel Co.,
Coatesville, Pa.

Improve Methods of Manufacturing

The successful manufacturer is not the one who reduces expenses by cutting the wages of his employes. He should select from those in his employ the most competent, those who can earn what they are paid, and encourage them to earn more.

We have, for a number of years, been giving special attention to the reduction of cost by improving the methods of manufacturing, and we are surprised at the saving that can be made in ways that we did not anticipate.

In our machinery department, the largest selling tool we have at the present time is our multiple spindle drill. We originally designed this, not with a view of placing it on the market, but to accomplish just what we have enumerated, namely, reduction of the cost of our typewriter department, and having found it an efficient tool for reducing the cost of drilling in our typewriter department, it occurred to us that it would be adaptable for reduction of cost in a great many other lines of manufacture. This has prompted us to bring out other drills of different sizes, ranging in weight from 1,000 to 26,000 pounds, and we will bring out larger sizes as soon as we effect a reorganization and get located in a building better adapted to handling heavy machinery.

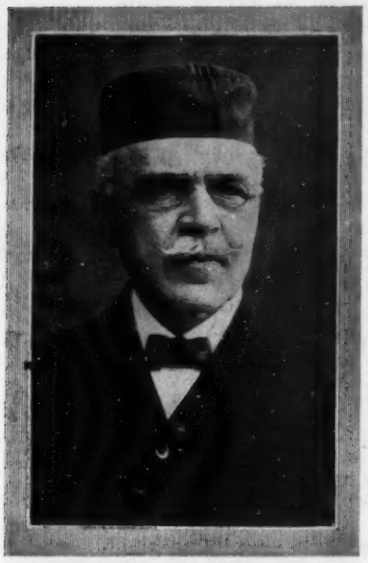
Of the different ways of encouraging greater loyalty on the part of the employe, our policy has been to treat them as equals, remembering that at one time we occupied exactly the same position that they do now. While it is difficult to satisfy every employe, yet, on the whole, we

have been fairly successful, never having had a strike or any labor troubles of any kind.

W. R. Fox.

Fox Machine Co.,
Grand Rapids, Mich.

New Tariff Law Will Not Be Disastrous



HENRY R. TOWNE

My reply to the inquiries in your letter of 21st inst. must be prefaced by the statement that for many years I have consistently favored and urged a reduction of the tariff on the ground that its rates were needlessly high, and that it tended increasingly to hamper the development of our foreign trade. Therefore, I am not one of those who are apprehensive that the tariff law now in effect will be disastrous to American industries.

I believe that some of the reductions recently made were too great, and that in some cases they may need revision, but, if so, I believe that the changes should not be made hastily, nor until the evidence is clear as to what may be needed. Meantime, my belief is that all of us should accept the new tariff in good faith and give it a fair trial.

Many plans are being tried to bring about closer identification of interest between employers and employes, and thereby to increase the loyalty and efficiency of the latter. I believe that all manufacturers should give serious consideration to the subject thus implied, and should cooperate in the development of methods for increasing the spirit of co-operation among employes. Out of the work now being done in this field will gradually evolve a science which will standardize the important and fundamental principles of good management and efficiency, but the application of these to any individual case will always necessitate the intelligent and sympathetic study of those in control, assisted, if possible, by the advice of experts who have specialized in these matters.

Henry R. Towne, *President.*

Yale & Towne Mfg. Co.,
New York.

Develop Energy and Ability

To meet the more active foreign competition, under the new tariff law, we would not reduce costs by lowering the quality of product, nor do we approve of lowering wages.

We believe this question can best be met by introducing new methods of manufacture, by the introduction of labor-saving devices, and the premium plan, under which the energy and ability of the workingman can be developed to the fullest extent.

H. H. Klusman.

Greaves, Klusman & Co.,
Cincinnati.

Introduce New Methods

We take from your letter of the 20th that it will be necessary for the machine tool manufacturers in the United States to reduce prices to meet foreign competition, and we do not see any other way of securing the necessary reduced cost of manufacturing to meet this competition unless it is by introducing new methods of manufacture.

We are not, however, contemplating any radical measures, but shall continue our policy of providing special appliances and careful supervision.

The William E. Gang Co.

Cincinnati.

Await Developments

We do not think anyone in our line of business is yet fully prepared to say what the effect of the new tariff law will be and as nothing that can be said at present will prevent the operation of the law, we think the only course is to await developments and be governed thereby.

Justus H. Schwacke, *Manager.*

Wm. Sellers & Co.,
Philadelphia.

Will Not Lower Quality

The Andrews & Hitchcock Iron Co. will not lower the quality of its Hubbard Scotch pig iron. It has manufactured it for a number of years and hopes it will keep on manufacturing it, but how or in what way, just at the present time I do not know.

Frank Hitchcock.

The Andrews & Hitchcock Iron Co.,
Youngstown, O.

Tendency of Corporations to Retard Progress

CHARLES WHITING BAKER

My opinion is that American iron and steel manufacturers can best hold their home trade against foreign competition by raising the quality of their products rather than by lowering it. Foreign manufacturers of iron and steel are active in endeavors to improve standard processes so as to eliminate piping of ingots, reduce segregation, lower the percentage of harmful impurities, and in general raise the quality and the service which the finished product will give. A large part at least of the iron and steel products now imported into the United States have obtained and held their market here because of superior quality. The achievements of some prominent makers of iron and steel products in the last half dozen years in the development of high grade materials and the building up of a large trade based thereon have well illustrated what are the possibilities in this field.

The tendency of the consolidations which have taken

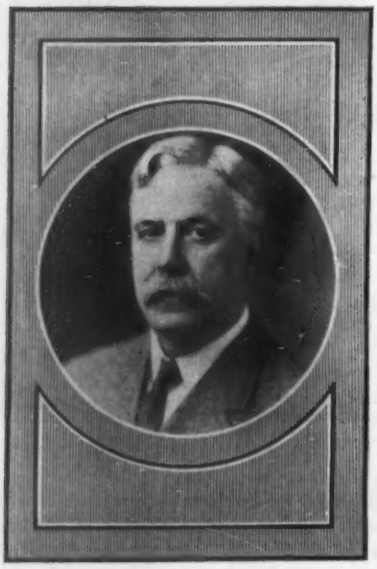
place during the last 15 years, with the increase in size of plant, the necessary red tape in organization, and perhaps more than all else the disappearance of personal responsibility for advancement and improvement have all contributed to stifle the progress of invention and the introduction of better methods and appliances in American iron and steel manufacture. This is merely a plain case of the operation of cause and effect. The superintendent or general manager of a great iron and steel plant and his staff employed on a salary have their attention concentrated on volume of production and reduction of cost. The comparison of the cost sheets of one works with another practically forces them to continue the rapid pace with little time or leisure to develop radical changes. If an outside inventor comes along with some new device or method, it is much the safer plan for the superintendent or manager to turn it down as nothing of importance. To take it up means a large outlay in most cases for trial and experiment, and if it eventually proves a failure, the whole blame will be laid upon the technical man who recommended its trial, whereas if it should prove a success, he receives no proportionate credit. This is doubtless the reason why most of the important improvements in metallurgical practice have been developed by the small independent concerns rather than by the great plants.

If the stress of foreign competition through tariff reductions shall induce American producers to awake to the progress which their foreign rivals have made, to eliminate some of our colossal waste in America, such as the continued use of the bee-hive coke oven, the enormous waste of natural gas in the oil fields, and the failure to utilize ammonia and tar by-products.—If it shall accomplish these things, it may well prove a blessing in disguise to the iron and steel industry.

CHARLES WHITING BAKER.

Editor-in-Chief
Engineering News,
New York.

Wretched Condition of European Shipments



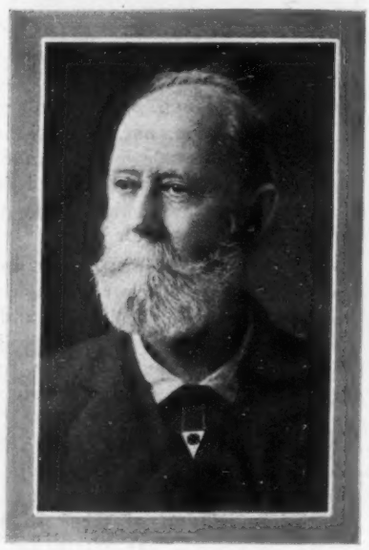
A. B. SCULLY

We are not manufacturers, our entire business being the handling, through warehouse, of the products of the large steel manufacturers, and we, therefore, must conform to their conditions, but from observation and experience we cannot figure out any reduction of cost by lowering the quality of the product; that would seem almost impossible, but, of course, eventually competition from abroad must necessarily reduce the labor. I think the modern mills of the United States have adopted every method for the reduction of cost in handling, and have understood that no country in the world can manufacture more cheaply. Have also, for some time, been of the opinion that, generally speaking, taking the standard lines, such as plates, shapes, sheets and bars, Europe under no conditions can touch the United States, even with our higher wages. Their methods are different from ours; their material is not nearly so good; our methods of handling the business, our standards and everything would make it most difficult for Europe to compete with us. The bulky stuff could not be handled aboard ship; shapes would have to be cut down to not exceed 40 feet in length, and bars would come over in such a frightful condition, being bent and rusty, that they would be considered almost useless. We are compelled to bring to this country quite large quantities of Norway and Swedish iron. There is still a large demand, and it comes over in the most wretched condition imaginable; the bars are bent in every possible way and covered with so much rust that it requires the stiffest kind of a brush to make them fit, and no buyer of material in the country would tolerate the manner in which this kind of material comes to this country, and sheets, No. 12 and lighter, would be practically ruined before reaching here. Therefore, we do not anticipate anything at all serious from Europe.

A. B. SCULLY.

Scully Steel & Iron Co.,
Chicago.

Treat Employes With Exact Justice



POWELL STACKHOUSE

The Cambria Iron Co. is not now an active company, having leased all their property to the Cambria Steel Co. and hence the tariff is of greater moment to the latter. Personally, I have been out of active business for nearly three years and can only answer your questions in a general way: To the first, no; to the third, yes; to the second, yes, but only when it is absolutely necessary to keep your plant in operation and furnish work for the employes. How the third question could be best carried out would be a local matter for the management at each plant.

To your last inquiry—treat your employes with strict justice, as liberally as conditions will permit, with due regards to the fair rights of the owners, and always as men, no matter how humble their position.

POWELL STACKHOUSE.

Philadelphia.

Systematic Manufacture

We have yours of the 21st inst., regarding conditions imposed on us by the new tariff. As to how we will meet these conditions, would say that we would under no circumstances consider reducing the quality of our machines to meet competition nor would we, unless absolutely driven to it, consider reducing wages, as we

believe reduction in wages would probably mean an increase in cost.

We are at present striving in every way to reduce cost by systematic manufacture, more systematic instruction and by simplifying our designs.

We believe; in these directions there is room for great progress, but we believe either of the others would only result in disaster.

W. P. HUNT, *Secretary.*

Moline Tool Co.,
Moline, Ill.

All Have Ideas

We all have our own ideas. About the only thing we can do is to wait patiently for the results of a new policy which this government has not thought best to put in force for many, many years.

If the free trade idea is a correct one, we shall all be glad to participate in the profits derived thereby. Personally I have no faith in it. I am a protectionist from the ground up, but am perfectly willing to allow the present administration to develop their theory, even though we do suffer severe losses in the end.

O. P. BRIGGS, *President.*

H. E. Wilcox Motor Car Co.,
Minneapolis.

Conditions Have Been Very Much Worse

J. G. BUTLER JR.

You make this statement: "The most important question confronting the manufacturers of the United States, today, is—How can manufacturing methods be improved so as to meet the more active foreign competition which the low tariff makes certain, etc., etc.?" It goes without discussion that no manufacturer will be foolish enough to lower the quality of his product, by any method. Seeking new foreign business would carry with it improvement of the product in every way. I think that the manufacturers of this country are alive to the introduction of new methods and are constantly on the lookout for them.

It is possible that wages may be reduced, automatically. The cost of living should be reduced; but if you know of anyone who has the wisdom to bring about this result, I should like to make his acquaintance.

I believe one step towards greater efficiency is already in force by the Steel Corporation and is being followed up by all the great independent concerns in the country—that is, the profit-sharing plan.

I must admit that we are confronted, today, with either an over-production or under-consumption. I believe the latter term fits the case more nearly.

I am in favor of the Interstate Commerce Commission granting the railroads the advance they have asked for. I believe this will be the turning point in the business situation. It is the somewhat general belief that the railroad people are withholding orders pending this decision. I doubt this very much. I think the railroads are buying all that they can get the money to pay for.

The crop situation has more to do with present business conditions than it has been given credit for. It must be admitted that 1913 crops have been below the average.

It also should be remembered that the business of the country has been under a constant strain for two years. Congress has been in session practically all of this time, and this, coupled with the craze for getting after "big business and trusts" fomented largely by the muckraking magazines, makes the conditions, at times, almost intolerable.

However, manufactured stocks are low both in the hands of jobbers and consumers; prices have surely touched bottom, and any change in the immediate future, will be for better prices.

The Sherman law should be amended. It should be taken out of politics and placed in the hands of a commission composed of trained lawyers and business men.

The spirit of co-operation among competitors should be fostered.

Taking it all in all, I have during my lifetime, seen conditions very much worse.

J. G. BUTLER JR.

Youngstown, O.

Employes Can Delay Wage Reductions

Replying specifically to your questions, I would say, unhesitatingly, that the Lackawanna Steel Co. would never contemplate reducing costs by lowering the quality of product.

In regard to reduction of wages, it has been prophesied that a low tariff would inevitably result in lower wages for American workmen. Upwards of 80 per cent of the cost of manufacture of finished steel is in the ultimate analysis labor, the remaining factors of cost being rentals and royalties; amoritization or depreciation; interest of capital invested; and profits to those from whom we purchase raw materials or supplies, and to the transportation companies which assemble them for us. It is evident that no great change can be expected in these items. Rentals and royalties cannot probably be reduced. Amoritization and depreciation may be disregarded temporarily, but must be reckoned with in the long run, and cannot properly be reduced. Interest on that part of capital invested, which is represented by funded debt, cannot be reduced. Railroad rates are fixed, and are likely to be increased, rather than decreased. Profits of those from whom we purchase raw material or supplies may be somewhat reduced, but it is evident that any material reduction in cost of finished steel, must come from reduced rates of wages, or from improved methods of manufacture calling for a decreased number of men, or from greater efficiency on the part of labor, or from all three. With the probability of decreased returns on capital invested in the business, it is unlikely that addi-

E. A. S. CLARKE

tional money necessary for the installation of improved machinery or methods can be obtained, and reductions of cost must come through greater efficiency of labor, through whatever can be accomplished by lessened waste of material, and in addition, if necessary, by reduced wages.

Every thoughtful employer of labor recognizes that with the present high cost of living, a reduction in wages would be a great hardship to his employes, and capital will probably for a time be content with a lessened return, rather than reduce wages. It is my judgment, however, that some reduction in wages will eventually be necessary. If workingmen will recognize the situation and give the employer at once the best of their energy and ability, the reduction in wages, when it comes, will be made as small as possible.

As to encouraging greater loyalty to employers among employes, I believe that some system, under which those employes who have rendered faithful and efficient service, shall, in some way, share in the profits of the business, will in the long run be productive of the best results.

E. A. S. CLARKE, *President.*

Lackawanna Steel Co.,
New York.

Introduce New Methods of Manufacture

I am in receipt of yours of the 17th inst., in which you refer to the important question as to whether manufacturing methods may be improved so as to meet the more active foreign competition, which the low tariff makes certain. The writer is unqualifiedly in agreement with the statement in your letter, that the manufacturers of the United States will not sit supinely and surrender their own home market to the foreigner. It would seem to be quite out of the question to meet the competition by lowering the quality of our products, and equally practically impossible to meet it by any considerable reduction in wages, without leading to a tie-up in American industry. This leaves, then, only the alternative of solving the problem by the introduction of new methods of manufacture. It is well known and has been well known by a number of people in this country for years past that German industry pays a considerable portion of its overhead or fixed charges by the utilization of waste products. This opens up a field for investigation, which American manufacturers have not up to the present time felt it necessary to give careful attention to. During the past years which have represented the great development of American industry, the manufacturers found their hands full in developing their main line of products and have overlooked very considerable values which they have been heretofore throwing away. In many cases in some of our great industries, by-product material is sold in its crude state to European manufacturers, who refine it, manufacture it into useful products and ship the material back to America to be sold. These profits can be very largely developed and utilized by American manufacturers and if the present tariff, in spite of the burdens which it places upon American industry, will serve in part to educate manufacturers to pay attention to these apparently minor problems of their industry, it will probably lead to good results in the end. It would not be difficult to cite particular instances of waste products of considerable value, which are overlooked by American industries and which it is to be hoped in the future will be worked up profitably by American manufacturers and not left for our foreign competitors to work over into valuable materials. This institute is already working with a number of manufacturers in different lines, looking to the solution of some of these many problems, and the field for expansion along this line seems to be very large.

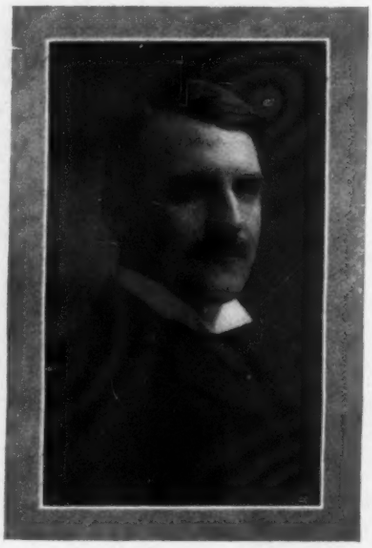
ALLERTON S. CUSHMAN, *Director.*

The Institute of Industrial Research,
Washington.

Give Workmen a Share of Savings

Your letter of Nov. 20 is very interesting to us, as we have been making a number of inquiries on the subjects mentioned. We are doing some work at the present time for a large machine tool building concern, which is very much affected by the new tariff and which has sent several of its officers to Europe to study conditions.

In answer to your first question: Would you reduce costs by lowering the quality of the product? We would say emphatically—No. We do know, however, that a great many concerns can decrease the cost of manufacture and increase the quality of their product by using better talent in the engineering department, designing their product so that unnecessary machining can be eliminated and parts manufactured and machined more economically. Mr. Stuart Dean, who has recently published a book on factory management, has expressed the same opinion in saying that many machines could be redesigned, so that the cost of manufacture could be decreased from 15 to 20 per cent, with increased value to the purchaser. In answer to your second question: Would you reduce costs by reducing wages? We do not believe it is necessary to reduce wages, and we believe such a move is impossible without labor troubles, which would in the end make costs higher rather than lower (unless the panic conditions of 1893 and 1907 should be brought about again).



WM. B. DICKSON

To reduce costs by introducing new methods of manufacture, is the solution of the problem. The introduction of new methods in manufacture, which is sometimes called "Yankee ingenuity" by foreigners, is the foundation upon which has been built nearly every big business in this country which competes with Europeans in their own territory. The management of every concern should make a constant study of the processes in use to discover any method of decreasing labor or material costs. A simple example of how this has been done is shown on some work we observed recently, which was being done on a vertical surface grinder. The use of this surface grinder had enabled the manufacturer to cut out the slow and costly process of planing and scraping. Not satisfied with this big reduction, he made a study to reduce the costs of grinding by devising a special form of magnetic chuck. The chucking time was reduced by more than half. Another large saving was made in the amount of stock removed in grinding. A calipering attachment was placed in the machine in such a way that the work could be brought to exact dimensions without any loss of time for stopping and testing. It is a surprising fact that in nine

out of ten machine shops one can find castings on which a large saving can be made by paying more attention to the amount of metal removed for finish.

To obtain the best energy and ability of a workman, he must be given a share on every saving which he makes. It has been proven time and again that a scientific wage payment plan, which gives the workman a share in the increase in output due to his efforts, will surely reduce costs, prevent labor trouble and increase the worker's wages. The difficult thing to understand is why so many firms are without such a plan. The wage plan is the answer to your question as to how we would encourage greater loyalty to employers among employes. If wages are set fairly, every workman can earn a living wage, and it will be to his interest to be loyal to the concern which has made him a profit-sharer.

We await with great interest the publication of your article covering the questions which you have submitted to us.

W. F. Rockwell.

Clinton H. Scovell & Co.,
Industrial Engineers,
Boston.

Abolish the Twelve-Hour Day

GEORGE E. STEEDMAN

Certainly, the lowering of quality of steel products should never be considered. In times of prolonged depression in the past, wages have always been reduced and, much as such a step is to be regretted, I think it is inevitable that this means of reducing costs must again be used. Certainly, an opportunity to work at a low wage is preferable to a theoretical high wage with the mills idle. I do not think the high living cost will be materially reduced until all of us, employer and workman alike, are driven by stern necessity to the practice of the old-fashioned virtues of frugality and thrift, of which the present generation seems to have lost sight. You may be surprised that I should take this opportunity to advocate a change which has always been opposed on account of added cost, namely, the abolition of the 12-hour day in the continuous processes. I understand that one of the reasons for delay in acting on the recommendation of the Steel Corporation stockholders' committee on this subject was the fact that the demand on the mills for deliveries was so urgent as to preclude the possibility of any radical change, especially one involving the securing of additional men. Now, that large numbers of men are idle, would it not be the best time to make a change to the eight-hour day, to which, I think, it is inevitable that the industry must come in the near future? As to further economies in manufacture, I can only suggest the further extension of such well known appliances as: By-product coke ovens; sintering or briquetting processes to conserve fine ore; gas engines; dry blast. You will note that all of these directly affect the production of pig iron and as that is the basis of the steel industry, any saving effected there is greatly increased in the finished product.

In the case of dry blast, the process can be used either to increase the output materially or in such times as we are now facing, to effect fuel economy.

William B. Dickson.

Montclair, N. J.

Reduction of Wages Should Be Last Resort

On competitive lines of manufacture, which will be affected by the new tariff law, the American manufacturer will no doubt find it necessary to give more attention to design, kind of material used and method of manufacturing, so as to meet the foreign market. It is natural to assume that manufacturers are now aiming to take advantage of labor-saving devices and employing modern methods of manufacture for the purpose of producing their work economically, but a greater ecort must be made in this direction and it is safe to say that more can and will be done when it is found necessary.

American manufacture in nearly all lines of commercial work, meets with home or American competition, which often calls for extreme economy in methods of manufacture, and it must be anticipated that foreign competition will be met in the same way.

When the profit on a line or class of work is satisfactory, there is a tendency to overlook small improvements which can be made to cheapen the cost by improving manufacturing conditions and give attention to lines which do not show a fair margin of profit, and if the first mentioned lines are affected by the new tariff law, more attention will be given to ways and means to cheapen the cost.

A knowledge of labor-saving machinery and devices, a careful study of manufacturing operations and the proper use of material is necessary to reduce cost to the fullest extent and machine tool builders have greatly assisted their customers in this respect.

The practice of some machine tool builders to study, recommend and demonstrate, if necessary, methods of manufacture to their customers, has been taken advantage of by machine tool users to some extent, and I believe greater use should be made of this service and this is a suggestion I can offer as to how labor-saving devices and machinery can be utilized to a greater extent. There are at present a great many systems in use for the purpose of giving workmen a greater incentive than the day rate wage, to use their ability and energy in the proper manner—thereby increasing their earnings, but unfortunately there is no well defined system to encourage workmen to be economical in the use of material and supplies except to penalize them for breakage or losses incurred by defective workmanship.

Welfare work and recognition of just demands made by employes should encourage loyalty to their employers, and an effort on the part of employers not to reduce wages on account of the reduction in the tariff should be appreciated by the employes.

The reducing of wages should be the last method considered to reduce cost, and it is doubtful if any reliable or constant saving can be made in this direction, as the wages paid are largely influenced by the condition of business and the value of the labor market in different districts.

E. R. Norris,
Director of Manufacturing Operations.
Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pa.

Adopt Premium System

In our judgment, in order to meet foreign competition:

1.—The quality of product will not be lowered by manufacturers.

2.—Wages cannot be reduced except when the supply is greater than the demand.

3.—The majority of manufacturers have been for years introducing new and most modern up-to-date methods of manufacture.

4.—We do not believe that material is wasted to any great extent.

5.—The energy and ability of the workingman is obtained by putting work on the premium system wherever possible.

6.—We believe that the majority of employers endeavor to be loyal to their employes, as otherwise, the best results cannot be obtained.

THE DETRICK & HARVEY MACHINE CO.

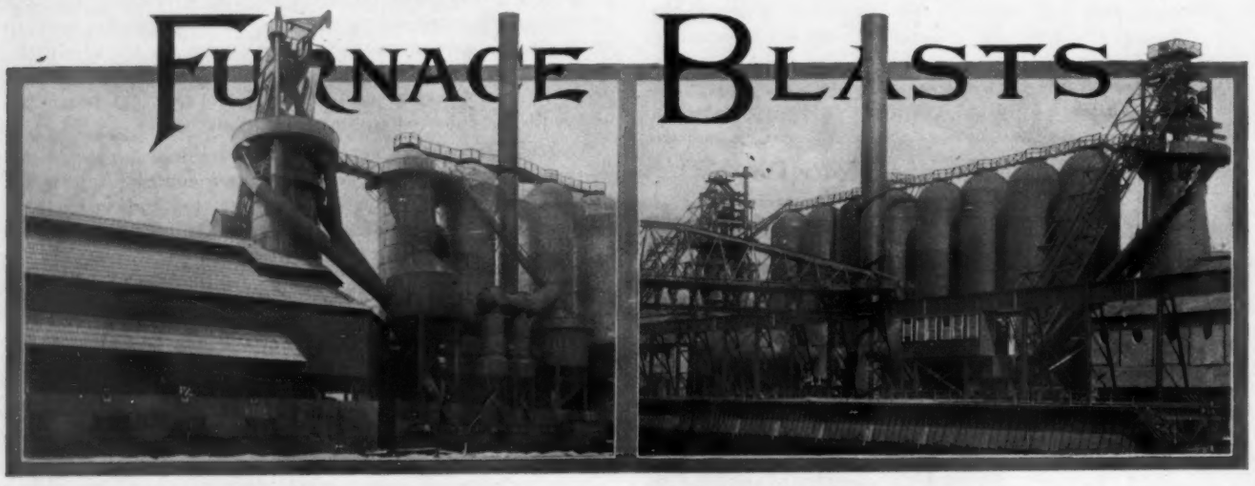
Baltimore, Md.

Increase Efficiency

Our idea of cost reduction is by increasing efficiency in manufacturing through standardization of output, design, and methods. Our hope in carrying out this plan is through attention to the details of design, sales and production, by careful selection of competent men and *training* them efficiently.

GEO. E. STEEDMAN, *President.*

Curtis & Co. Mfg. Co.,
St. Louis.



Thin Linings and Bosh Jackets

Early experiments with thin linings for blast furnaces are referred to in a personal letter from E. A. Uehling, Passaic, N. J., to a friend who has been largely instrumental in introducing the new practice. Mr. Uehling says:

"There is no doubt in my mind that the thin-lined furnace is the furnace of the future. I believe that I was one of the first to advocate and to some extent put this idea into practice, after having made some experiments with a furnace bosh. I inserted six rows of pipes reaching alternately 9 inches and 13½ inches into a 22½-inch bosh wall by which I demonstrated that the first 9 inches were worn away in four weeks, and in nine weeks there wasn't a single pipe reaching 9 inches into the walls that did not blow gas and had to be stopped up with clay. This was at Sharpsville furnace in 1885 or 1886.

"I then went with the Bethlehem Steel Co. and relined one of its furnaces, making the bosh walls only 16 inches, the bosh outlasting the lining. Later, in relining two furnaces of the Sloss Iron & Steel Co., Birmingham, Ala., I used 13½-inch brick for the bosh wall. The construction of one of these furnaces had some similarity with yours, inasmuch as the new bosh jacket was hung within the old one, leaving a space of from 9 to 15 inches between the two. Windows were cut in the old bosh jacket and a water spray was arranged between the two. This was in 1892 or 1893, prior, as you see, to the general introduction of bronze bosh plates. About that time, or a year or so later, I designed a furnace for the Sloss Iron & Steel Co., which was to have cast iron construction about 20 feet down from the top, water-cooled, and without any lining whatever. This was too radical for the times and had to be given up.

"On my sojourn in Europe from 1898 to 1901, I had occasion to see Mr. Burgess's thin-lined furnace and on my return I endeavored to interest the American blast furnace people in this construction, but it was too soon. They had to have eight or ten years to think it over."

J. J. Gray Jr., manufacturer of ferro-phosphorus, who operates mines at Pinkney, Tenn., and a furnace at Rockdale, Tenn., writes as follows:

"I have never used the thin lining in my blast furnace here, except in the bosh. I have a steel bosh jacket, on which I keep a spray on the outside, and only have nine inches of brick against this jacket. This has proven very satisfactory, and the only reason I have not put in a thin lining all the way up is that it would require a new shell."

In line with the above is the practice of the Wellston Steel & Iron Co., Wellston, O., which advises that it has placed bosh jackets on all of its furnaces. This it has found an improvement over the old thick wall construction with plates for cooling. Very light lining for inwalls has never been tried by this company; but its inwalls are thin compared with most furnaces; 22½ inches being the thickest used. From that they have scaled down to 18 inches. No cooling water is used on the shells of the furnaces.

Year of Fair Profit in the Pittsburgh District

Remarkable Period of Prosperity Followed by Steady Decline in Prices and Demand —Conservatism Prevents Mills From Being Overloaded With Low Priced Orders

By C F Williams*

FROM a retrospective viewpoint, the 1913 iron and steel market is considered satisfactory, much more so, in fact, than an analysis of price tables for the year would indicate. The remarkable period of prosperity that extended over the first six months more than discounted depressed conditions that characterized the market the last quarter of the year. At no time during the year just ended were prices abnormally high, but their regularity during the first eight months enabled manufacturers to enjoy fair margins of profits. Conservatism, displayed by mill owners after low prices came out, prevented a complete demoralization, and excluded speculative buying, which would have filled mills with low priced tonnage for shipment in 1914.

Changes in the national administration, resulting in the removal of a protective tariff and a probable radical change in the currency system; European wars, and what has threatened to be serious trouble in Mexico; the delay in acting upon the request of railroads, east of the Mississippi and north of the Potomac rivers, for increased freight rates, and the floods and high waters that swept over western Pennsylvania, Ohio and West Virginia in March, summarily putting out of commission industries situated along the rivers in those sections, all had unfavorable influences upon the iron and steel markets of the United States in 1913.

In some respects, the 1913 market was similar to that of 1911, although prices in 1913 were much higher; the trend of prices in 1913 was directly opposite to that in the preceding year, when quotations steadily advanced, and yet, the year just ended was more profitable than 1912.

During the first six months of the year, blast furnaces and finishing mills were driven at utmost capacities, and production records were broken in practically every department of the iron, steel and allied trades. It was some time after the opening of the second half of the year before mills solicited additional tonnages, and very few of them could promise early deliveries until the latter part of the third quarter.

Increased capacity, especially in reference to open-hearth steel billets and sheet bars and steel sheets, had its effects upon the market, although prices were not affected until the middle of the year.

During the first eleven months of 1913 the following declines in prices were recorded: Bessemer pig iron, $2.25; basic, $3.75; foundry, $4; malleable, $3.75; steel bars, $4; iron bars, $7; plates, $4; shapes, $3; heavy melting steel scrap, $4.25; tin plate, $4; galvanized sheets, $11; black sheets, $9; blue annealed sheets, $7; billets, $9; sheet bars, $9; wire products, $5; steel pipe, $2.

Despite heavy demand, resulting in record-breaking production the first five months, pig iron merchants do not regard 1913 as a satisfactory year, from a remunerative standpoint. Tables show that comparatively high prices prevailed the greater portion of the 12-month period, but it is recalled that the bulk of the tonnage shipped was obtained at rather low figures. Higher prices for ore and coke and increased wages to laborers all tended to reduce profits. Many stacks were blown out the last six months of the year, because of unfavorable conditions. In November, there was a net loss of 19 active stacks. Production in 1912 was 29,726,987 tons; figures for 1913 will exceed those of the preceding year, by about 1,000,000 tons.

The trend of prices in 1913 was directly opposite to that in 1912, and very similar to that in 1911. In 1913, as in 1911, quotations were high at the beginning and low at the end of the year; in 1912, they advanced from low to high levels.

Bessemer pig iron, in 1913, declined from $18.15 to $15.90, or $2.25 a ton; in 1912, this grade advanced $3.25, from $14.90 to $18.15. Basic, in 1913, declined from $17.40 to $13.65, or $3.75 a ton; in 1912, this grade advanced $4.10, from $13.30 to $17.40. Foundry, in 1913, declined from $18.40 to $14.40, or $4 a ton; in 1912, this grade advanced $4.50, from $13.90 to $18.40. Malleable, in 1913, declined from $18.15 to $14.40, or $3.75 a ton; in 1912, this grade advanced from $13.55 to $18.15, or $4.60 a ton. These figures are for delivery at Pittsburgh, subject to a 90-cent freight rate from the valleys.

Bessemer pig iron, during January, February and March, was held at $17.25, valley, or $18.15, Pittsburgh, but sales during the first quarter were light. The price of this grade fell off 25 cents a ton the second week in April, and remained stationary at $17.90, Pittsburgh, until June. During that month, the minimum quotation fell from $17.50 to $16.90, Pittsburgh; a 50-cent decline featured the market for July, and at the end of that month Bessemer was listed at $16.40. Prices advanced 25 cents a ton the middle of August, and the market was pegged at $16.65, Pittsburgh, until the latter part of October, when it declined to $16.40. Two declines of 25 cents each were recorded in November; at the beginning of December, Bessemer was named at $15.90, Pittsburgh, and that figure continued

*Associate editor The Iron Trade Review. Graduated from University of Illinois, 1910; daily newspaper work 1910, '11, '12; joined staff The Iron Trade Review, May 6, 1912; placed in charge of Pittsburgh office, Aug. 1, 1912.

to represent the market until the end of the year.

Basic, which was listed at $17.40, Pittsburgh, Jan. 1, had declined to $17.25 by the end of that month; at the end of April, this grade was listed at $16.65, Pittsburgh. Rather sharp declines featured the basic market in May; during the last two weeks of that month, standard basic was selling at $15.65, or $1.75 a ton less than it commanded at the beginning of the year. The trend of the market continued downward during June and the first half of July, after which time this grade fluctuated considerably for several weeks. On July 10, THE IRON TRADE REVIEW listed basic at $15.15, Pittsburgh; on the 17th we quoted $15.40, and the following two weeks this grade was named at $15.15, Pittsburgh. Early in August, basic declined to $14.90, Pittsburgh, but showed strength the last three weeks of the month, being held at $15.15, Pittsburgh. The market was stationary until the end of September, after which time quotations gradually declined. On Oct. 30, basic was named at $14.65; this grade was held $14.15, Pittsburgh, the first three weeks of November; during the last week in November and the first week in December, standard basic was quoted at $13.90, Pittsburgh. During the last three weeks of the year, basic was hovering around $13.65, Pittsburgh, or $12.75, valley.

Foundry, malleable and gray forge displayed weakness similar to that reflected by steel making grades during the year just ended. Foundry, quoted at $18.40 Jan. 2, had declined to $14.90, Pittsburgh, by the beginning of the second half, but remained at that figure during the third quarter. During the fourth quarter, this grade declined to $13.50, valley, and some tonnage was sold at less than that figure. Malleable was listed at $18.15, Pittsburgh, Jan. 2, and at $15.15, July 1. Before the end of the year, malleable was selling on the same basis as foundry. Gray forge, during the year, declined from $16.90 to $13.90, Pittsburgh.

Sales of pig iron in 1913 fell far below those of the preceding year from a tonnage standpoint. In January, the Jones & Laughlin Steel Co. obtained 40,000 tons of Bessemer, at about $17.25, valley, and a month later the Colonial Steel Co. purchased 1,500 tons of basic at $16.25, valley. The Carbon Steel Co., in March, took 12,500 tons of basic, at about $16.10, valley. The Jones & Laughlin Steel Co. closed negotiations for 15,000 tons of prompt basic that month at about $16.10, valley, and the Standard Steel Car Co. at about the same time concluded negotiations for 42,000 tons of basic at $16, valley. The Youngstown Sheet & Tube Co., the middle of April, obtained 5,000 tons of Bessemer for prompt delivery, at about $17, valley. In June, the Republic Iron & Steel Co. obtained 60,000 tons of Bessemer pig iron from M. A. Hanna & Co. through an ore exchange, which took the Fannie furnace out of the merchant market for the remainder of the year.

The latter part of July, the Youngstown Sheet & Tube Co. took about 75,000 tons of Bessemer and basic, at about $15.50 and $14, valley furnace, respectively. This purchase involved more tonnage than any other individual order placed in 1913. In August, the Carbon Steel Co. obtained 10,000 tons of basic; the American Steel Foundries and the Jones & Laughlin Co. each took about 10,000 tons of the same grade, and the Colonial Steel Co. closed for 25,000 tons of basic, at prices ranging from $14 to $14.10, valley. The United States Steel Corporation, for the first time in 18 months, figured in the market in August, taking 10,000 tons of prompt basic at about the current price. During the last quarter of the year, numerous basic tonnages were obtained through sheet bar exchanges.

Plates and Shapes

The most noticeable feature of the 1912 market, with reference to steel plates, was the unusually heavy buying of cars on the part of leading railroads throughout the country, and it was pointed out 12 months ago by the writer of the Pittsburgh report that in the neighborhood of 235,000 cars were ordered, as against about 136,000 for 1911. In 1913, conditions were quite the opposite to those prevailing in 1912. Railroads did not buy heavily, and showed no great interest in covering future needs. It is roughly estimated that 1913 orders involved only about 100,000 cars, or less than half as many as were purchased the preceding year. Car shops ran at maximum capacity the first six months and operations continued at a fair rate in the third quarter, but plants slowed down considerably the last three months of the year. Buying probably will not be heavy until after railroads are granted an increase in freight rates in the eastern part of the United States, but the Interstate Commerce Commission will not announce a decision in reference to the new rates until spring.

(*Continued on page* 84)

MINIMUM MONTHLY PRICES AT PITTSBURGH IN 1913

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Bessemer	$18.15	$18.15	$18.15	$17.92	$17.90	$17.26	$16.65	$16.52	$16.65	$16.60	$16.09	$15.90
Basic	17.40	17.29	17.03	16.77	16.15	15.46	15.25	15.07	15.09	14.85	14.09	13.65
No. 2 foundry	18.40	18.21	17.65	16.71	15.72	15.04	14.78	14.71	14.90	14.80	14.59	14.40
Malleable	18.15	18.09	17.65	16.65	15.75	15.28	15.05	14.90	14.96	15.15	14.77	14.40
Gray forge	17.05	17.15	17.02	16.46	15.35	14.78	14.55	14.40	14.40	14.40	14.34	13.90
Ferro manganese (Baltimore)	65.00	65.00	64.25	61.75	59.80	59.00	58.60	55.62	55.00	49.60	49.00	47.00
Ferro silicon	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00
Bessemer billets	28.00	28.88	29.00	29.00	27.70	26.50	26.50	26.12	25.00	23.00	20.87	20.00
Open-hearth billets	28.70	29.38	29.50	29.50	28.10	26.50	26.50	26.12	25.00	23.00	20.87	20.00
Bessemer sheet bars	28.70	29.38	29.50	29.50	28.40	27.50	27.50	27.12	25.62	23.80	21.75	21.00
Open-hearth sheet bars	29.20	29.88	30.00	30.00	28.80	27.50	27.50	27.12	25.62	23.80	21.75	21.00
Steel rails	1.25c	1.25c	1.25c	1.25c	1.25c	1.25c	1.25c	1.25c	1.25c	1.25c	1.25c	1.25c
Beams	1.45c	1.45c	1.45c	1.45c	1.45c	1.45c	1.45c	1.45c	1.41c	1.37c	1.30c	1.25
Plates	1.45c	1.45c	1.45c	1.45c	1.45c	1.45c	1.45c	1.44c	1.40c	1.34c	1.25c	1.18c
Steel bars	1.40c	1.40c	1.40c	1.40c	1.40c	1.40c	1.40c	1.40c	1.40c	1.40c	1.31c	1.21c
Iron bars	1.70c	1.70c	1.70c	1.70c	1.70c	1.69c	1.65c	1.60c	1.57c	1.51c	1.47c	1.40c
Tin plate	$3.60	$3.60	$3.60	$3.60	$3.60	$3.60	$3.60	$3.60	$3.55	$3.50	$3.40	$3.40
No. 28 black sheets	2.31c	2.35c	2.35c	2.35c	2.35c	2.28c	2.25c	2.20c	2.12c	2.02c	1.97c	1.88c
No. 28 galv. sheets	3.46c	3.50c	3.50c	3.50c	3.40c	3.39c	3.32c	3.25c	3.15c	3.07c	2.97c	2.87c
No. 10 blue annealed sheets	1.71c	1.75c	1.75c	1.75c	1.75c	1.75c	1.72c	1.65c	1.61c	1.56c	1.47c	1.40c
Wire rods	$30.00	$30.00	$30.00	$30.00	$30.00	$29.50	$28.60	$27.62	$27.50	$26.80	$26.00	$25.75
Wire nails	1.75c	1.75c	1.75c	1.76c	1.80c	1.78c	1.70c	1.66c	1.65c	1.62c	1.59c	1.55c
Plain wire	1.55c	1.55c	1.55c	1.56c	1.60c	1.58c	1.50c	1.46c	1.45c	1.42c	1.39c	1.35c
Hoops	1.60c	1.60c	1.60c	1.60c	1.60c	1.60c	1.60c	1.60c	1.58c	1.60c	1.50c	1.41c
Heavy melting steel	$14.95	$14.50	$14.25	$14.44	$13.75	$13.06	$12.50	$12.50	$12.50	$12.25	$11.50	$11.00
Structural rivets	2.20c	2.20c	2.20c	2.20c	2.17c	2.14c	2.08c	2.00c	2.00c	1.92c	1.80c	1.75c

New Year Opens With Hopeful Signs in East

Collapse of the Market Marked by Interesting Features—Results of Tariff Not Fully Determined—Limited Buying by the Railroads—Shipping Less Active

By C J Stark*

IN 1913, the pendulum of the iron and steel industry of the United States swung to its highest point, hung there for several months under the momentum of its expansive activity and then reversing its course, passed steadily toward the opposite extreme where production and prices reached the lowest point in 18 months. As the year closed, this reverse movement had extended to the stage of slowest progress and indications were multiplying that the market again was closely approaching the ultimate point where a revival of trade might be inaugurated.

The collapse of the market of 1913 has been marked by some singular phases. Once the slackening of demand made itself felt broadly by the mills, the drop in prices was unusually swift and precipitate. In practically six months, a decline of $6 or $8 a ton in finished steel products had been registered. In the same period, pig iron prices slumped $3 to $3.50 a ton. The slightest support of the market structure through co-operation among producers and consumers appeared to be lacking. In this connection, attention is called to the unusually low stocks in practically all products, now generally reported in consumers' hands. Apparently, there has been no occasion in the decline of the past year for the upholding of values to permit large supplies in jobbers' and second hands to be worked off without disaster, such as had existed in some other recent years. The forces of supply and demand freely have operated to depress prices.

The present liquidated condition of stocks in the country apparently is another way of proving the soundness of the consumption conditions that prevailed during the active market of 1912 and of part of 1913. It raises the question as to just how far the present depression in the steel industry can be ascribed to changes in fundamental conditions or to sentimental influences. Apparently, the latter have been a strong factor in the wane of confidence. In fact, the general business recession of 1913 frequently has been described by well-informed men as a "sentimental depression".

To outline the factors of importance in the reaction of sentiment, the revision of the tariff must be accorded a prominent position. Yet, the direct effect of the reduction of duties in stimulating foreign competition along the Atlantic coast and at other near seaboard points, which geographically are open to invasion, has been so trivial as to excite little or no apprehension. Pending currency reform undoubtedly has been a powerful disturbing cause as well as other legislative uncertainties. Again, apparently, the uncertainties over national legislation rather than the actual provisions of laws when finally in effect, have contributed strongly to the timidity of business. The financial situation has reflected the presence of a world-wide strain attributed by many to recent European wars and a reluctance of capital to reach out while basic conditions of conducting business in this country were undergoing modification. At the present time, the steel industry is disposed to attach much importance to the pending petition of the railroads east of the Mississippi and north of the Ohio and Potomac rivers, for a general advance of 5 per cent in freight rates. A successful outcome of this effort is expected materially to increase the buying power of the steam roads of the country, which during the past year has been much restricted in all iron and steel products.

Workings of the Tariff

When the Underwood tariff bill, free-listing pig iron, raw steel, iron ore and other crude materials and cutting former duties on plates, shapes, bars and other finished products about 50 per cent, went into effect Oct. 3, there was strong curiosity in the iron and steel industry, not unmixed with uneasiness, to see how the new order of things would operate. Four months of a low tariff regime since then probably have not been sufficient to test the ultimate result of such conditions. Nevertheless sufficient opportunity has been presented to cast some light upon the question whether iron and steel makers of the United States will be obliged seriously to reckon with English, German and Belgian mills as probable contenders for future trade in this country.

The limited results so far developed all have been in favor of the home producer. Actual instances of foreign steel products supplementing domestic material have been wholly negligible as far as the eastern seaboard zone is concerned. This has been true, notwithstanding the fact that foreign bars and billets at times have been offered considerably below domestic prices. German Bessemer steel bars were offered around 1.25c, duty paid at New York and other leading Atlantic ports, when the domestic market was fully $5 to $6 higher. German billets were quoted at $21, seaboard, or about $22.50, at eastern Pennsylvania consuming points when the home makers were asking about $24, delivered. Yet except in extremely rare cases, and these only involving inconsequential lots, the consumer expressed a preference for

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the home product and seemed willing to pay considerably more for it, depending on the article. Just how much a differential over foreign steel buyers in competitive territory permanently will pay home makers for the advantages of assured quality and standards, of closer mill connections, of more flexible credits, and of other factors, remains an interesting question to be determined by future developments. The conviction gains ground, however, that the new tariff law will tend to operate effectively only on high markets; in other words, it will prove a barrier to excessive rises in prices. This opinion, of course, assumes that foreign markets will not advance in the same proportion as domestic prices. What truth there is in this theory remains for the future to disclose, for up to this time the reduced tariff has ruled only when a low market and an indifferent demand have existed both in this country and abroad.

In pig iron, not a single sale of Middlesbrough, English foundry irons has yet resulted in eastern territory since the free entry of this product was established. Middlesbrough No. 3 was available on occasions as low as $14.25, on docks at eastern ports. Northern and southern irons of comparable grade, however, at all times were able, all conditions considered, to compete with the foreign metal. Some small sales of English hematite iron of 0.03 phosphorus quality were made at $20.50, Philadelphia. In this grade, the competition of English irons had the effect of forcing down the prices of domestic standard low phosphorus iron about $1 to $2 a ton.

Eastern Mill Conditions

During the first half of the year, eastern makers of finished and semi-finished steel enjoyed a continuation of the very prosperous conditions of the last half of 1912, when prices were most satisfactory and the mills were groaning under specifications. In these six months, a high record rate of operations was maintained. In January some eastern makers produced the largest ingot tonnage in their history. From July on, the troubles of manufacturers to keep their plants running full, multiplied. Conditions gradually grew worse, until in December outputs had been cut to 30 to 40 per cent.

The year's decline in plates and shapes for eastern makers represented about $8 a ton. The plate mills were able to hold a price of 1.75c, Philadelphia, or 1.60c, Pittsburgh, throughout the first half and a break of $1 was not recorded until in June. In August, a cut of $2 a ton more was sustained. The rest of the decline fell in November and December, when the market was at 1.20c to 1.25c, Pittsburgh, or 1.35c to 1.40c, Philadelphia. Shapes did not fare as well as plates. Eastern makers who were quoting 1.75c, Philadelphia, or 1.60c, Pittsburgh, which was above the price of the larger makers, dropped to the general market level of 1.60c, Philadelphia, in May. They maintained this price until about August, when a decline of another $1 occurred. The slump for the remainder of the year was sharp and the net loss in that period was $4 a ton, to a level of 1.35c, Philadelphia, in December. Eastern shape makers closed the year with very irregular operations, the mills being down for one or more days a week.

The eastern bar industry, on the whole showed up well during most of the year. Steel bars were the most staple of all finished products, holding uniformly to the full 1.40c, Pittsburgh base, or 1.55c, Philadelphia, from January until in October. In the last quarter, the decline was $4 a ton and leading makers were selling at 1.20c, Pittsburgh, or 1.35c, Philadelphia, at the year's close. Eastern makers of bar iron were the most prosperous in several years up to July and plants which had not been active for several years were pressed into service. The demand upon manufacturers in sympathy with steel bars was very heavy and prices at times reached as high as 1.70c, mill. After July, however, the market rapidly passed from one lower state to another and price conditions became very ragged. Under 1.20c mill was being done by some makers of common bars in December, and new business was extremely scant.

The Steel Corporation continued early in the year to be a patron of eastern Pennsylvania makers of billets in order to make up shortages in its own supply. From 30,000 to 40,000 tons of steel were purchased by the leading interest at various times. The largest lot was 15,000 tons, taken by the National Tube Co., in April. Under the scarcity of steel which was in evidence everywhere in the country, eastern billet makers were enabled to obtain advancing prices up to April. In that month, rolling billets were selling at $30, Philadelphia, which was an advance of about $1 a ton from earlier in the year. The market then began to settle and prices in June and July were $1 under the January level. This decline continued steadily to December when as low as $21, delivered eastern Pennsylvania, was understood to have been done, representing a net price loss of $8.50 in the year. The mills then were running very light and were planning shut-downs of indefinite length over the holidays.

Eastern Iron Declines Slowly

Eastern Pennsylvania producers of merchant iron in 1913 lost all the price advance they had gained in 1912 and started the new year at approximately the market level which had prevailed on the corresponding date two years before. This was $14 to $14.25, furnace, for the strictly standard brands of No. 2X, $13.50 to $13.75 furnace, for standard forge, while basic nominally quoted at $15, delivered, in the absence of sales was probably not far from $13.75 to $14,

(*Continued on page* 102)

AVERAGE MONTHLY PRICES OF RAW AND FINISHED MATERIALS IN EAST DURING 1913

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Basic, pig iron, eastern Pennsylvania..	$18.25	$18.00	$17.50	$16.50	$16.50	$16.00	$15.25	$15.00	$15.25	$15.25	$15.00	$14.25
No. 2X foundry, Philadelphia	18.25	18.00	17.75	17.50	17.00	16.25	15.50	15.75	16.00	15.75	15.50	15.00
No. 2X Virginia furnace.....	16.00	15.50	15.50	15.00	14.50	13.75	13.00	13.00	13.00	13.00	13.00	12.75
Standard low phosphorus, Philadelphia..	24.50	24.50	24.00	23.50	23.50	23.50	23.50	23.00	23.00	23.00	21.50	21.00
Standard gray forge, Philadelphia.....	17.50	17.00	16.50	16.25	15.75	15.25	14.75	14.75	14.75	15.00	14.75	14.50
Open-hearth billets, 4 x 4 Philadelphia.	29.50	29.00	30.00	30.00	29.00	28.50	28.50	27.50	25.50	24.50	23.00	21.50
No. 1 heavy steel, eastern Pennsylvania	14.50	13.50	13.50	13.75	12.50	12.00	11.50	11.75	12.00	11.00	10.25	10.00
No. 1 railroad wrought, eastern Pa....	16.25	15.75	15.50	16.00	15.50	14.75	14.25	14.50	14.50	14.25	13.50	13.00
Heavy machinery cast, eastern Pa.....	15.25	14.50	14.00	13.25	13.50	13.25	13.25	13.25	13.25	13.25	12.75	12.50
Tank plates, base, Philadelphia.....	1.75c	1.75c	1.75c	1.75c	1.75c	1.75c	1.65c	1.55c	1.55c	1.55c	1.45c	1.40c
Structural shapes, base, Philadelphia....	1.75c	1.65c	1.65c	1.65c	1.60c	1.60c	1.60c	1.55c	1.55c	1.45c	1.40c	1.35c
Steel bars, base, Philadelphia.....	1.55c	1.55c	1.55c	1.55c	1.55c	1.55c	1.55c	1.55c	1.55c	1.45c	1.40c	1.35c
Common iron bars, eastern Pa. mill....	1.65c	1.60c	1.60c	1.55c	1.50c	1.45c	1.40c	1.30c	1.30c	1.30c	1.25c	1.20c

Bethlehem Steel Co. Additions and Improvements

How Duplexing Operations and Capacity Have Been Facilitated and Increased by the Addition of Open-Hearth Furnaces and a Special Converter Plant

By C J Stark

IN PRACTICALLY every plant where the duplex method of steelmaking has been adopted in this country in recent years, the main underlying purpose has been to provide a flexibility of output with fixed capacity, which could be adjusted readily to various conditions of market demand. The possibilities for maximum tonnage with this combination of the Bessemer and basic open-hearth processes, or for a limited production when operating with open-hearth furnaces exclusively, in this respect have made it the ideal system for meeting economically the sharp business fluctuations to which the steel industry of the United States has been subject.

It has been pointed out repeatedly that there have been other practical factors which have further contributed to the advantages of the duplex process. These other considerations have been the utilization of Bessemer equipment rendered less serviceable by the increased demand for open-hearth products; the higher phosphorus character of the great mass of the available iron ores; the desire of steelmakers to protect themselves against the fluctuations of the scrap market and some other causes of more or less importance.

The adoption of the duplex process by the Bethlehem Steel Co., South Bethlehem, Pa., at its Saucon plant in 1911 has been based from the beginning upon all of these factors, but primarily it has come about through a desire to speed-up the output when the occasion required it. Actual results at this plant have shown that a saving of about 65 per cent in time for a given tonnage of steel is effected by duplexing. The original steel works of the Saucon plant were completed in 1907, and consisted of ten 60-ton open-hearth furnaces. There also was installed and placed in operation in 1907 the Grey universal structural mill for rolling wide flange I-beams and H-sections, commonly known as the Bethlehem sections. In addition, the Saucon finishing capacity includes a standard structural shape mill and a standard rail mill.

After the open-hearth plant had been in operation for four years, a Bessemer unit was added, designed solely for duplexing purposes. So great has continued the demand for the products of this plant, especially for the special and standard structural shapes, that in 1912 it was determined to greatly increase the ingot capacity by the addition of six 75-ton basic open-hearth furnaces, the rebuilding of the Bessemer works and some other necessary alterations. These improvements are now completed and the increased capacity only recently has been employed to its capacity. The output of the steel works now is about 70,000 to 75,000 tons of ingots monthly when operating on the straight open-hearth basis. Just how much the maximum production of the works would be under the Bethlehem practice when run steadily at duplexing, has not been finally determined. It is estimated, however, that it will reach fully 100,000 tons monthly.

During 1913 considerably in excess of 250,000 tons of the special Bethlehem sections were rolled and marketed. The additional steel capacity

FIG. 1—TAPPING SIDE OF SAUCON OPEN-HEARTH FURNACES

FIG. 2—OPEN-HEARTH FURNACE CHARGING FLOOR

at the Saucon plant now enables the company to produce from 350,000 to 400,000 tons of Bethlehem sections annually, in addition to the regular output of standard structural shapes and standard rails. It is believed that the Saucon plant now has as large a potential capacity for structural steel as any single independent mill in the country.

The extensions to the Saucon plant comprise an enlargement of the open-hearth steel works, a newly-built Bessemer and mixing department with some additional equipment and other auxiliary improvements such as the increase of electrical power, rearrangement of pig metal and transfer tracks and some other readjustments of former capacity in the interest of a closer continuity of operations.

The Bessemer and mixing plant now is located at the east end of the extended open-hearth building which

FIG. 3—THE RAIL MILL

FIG. 4—VIEW FROM 28-INCH STRUCTURAL MILL, SHOWING SAWS AND HOT BEDS

it partially adjoins. When first built in 1911, it occupied a position southeast and in close touch with the former open-hearth works, but the extension of the latter prevented short track connection between the two steel departments. To have continued it on its former site would have made necessary a more round-about haul of metal to join the two steel works in a single process and a consequent loss of both time and efficiency. As from the beginning, the Bessemer plant at the Saucon works has been intended primarily for the duplex process, this question of quick and easy transfer of metal has been of essential importance.

The new extension to the open-hearth plant consists of six basic furnaces of 75 tons capacity each. They occupy a building 160 x 800 feet, which is of the usual heavy type of mill construction. The furnaces have no unusual features of design and follow the lines of the most modern and latter-day steelmaking stationary

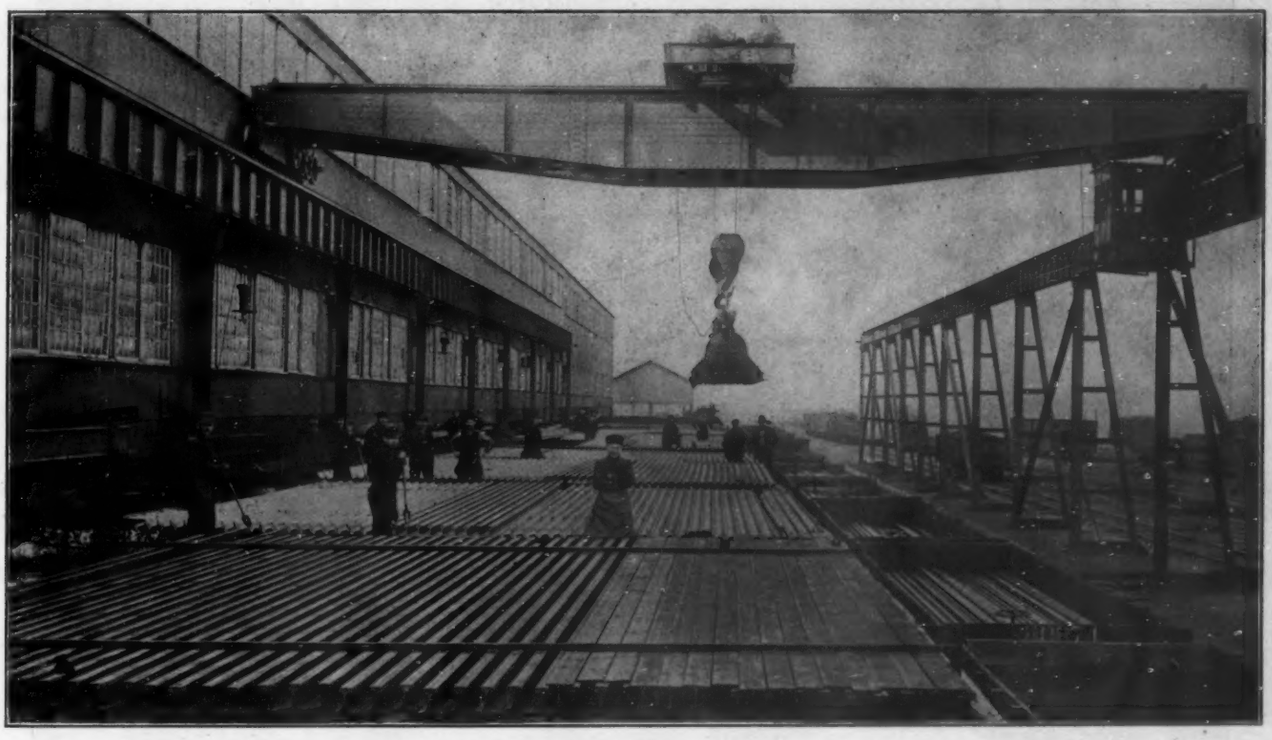

FIG. 5—THE RAIL MILL YARD

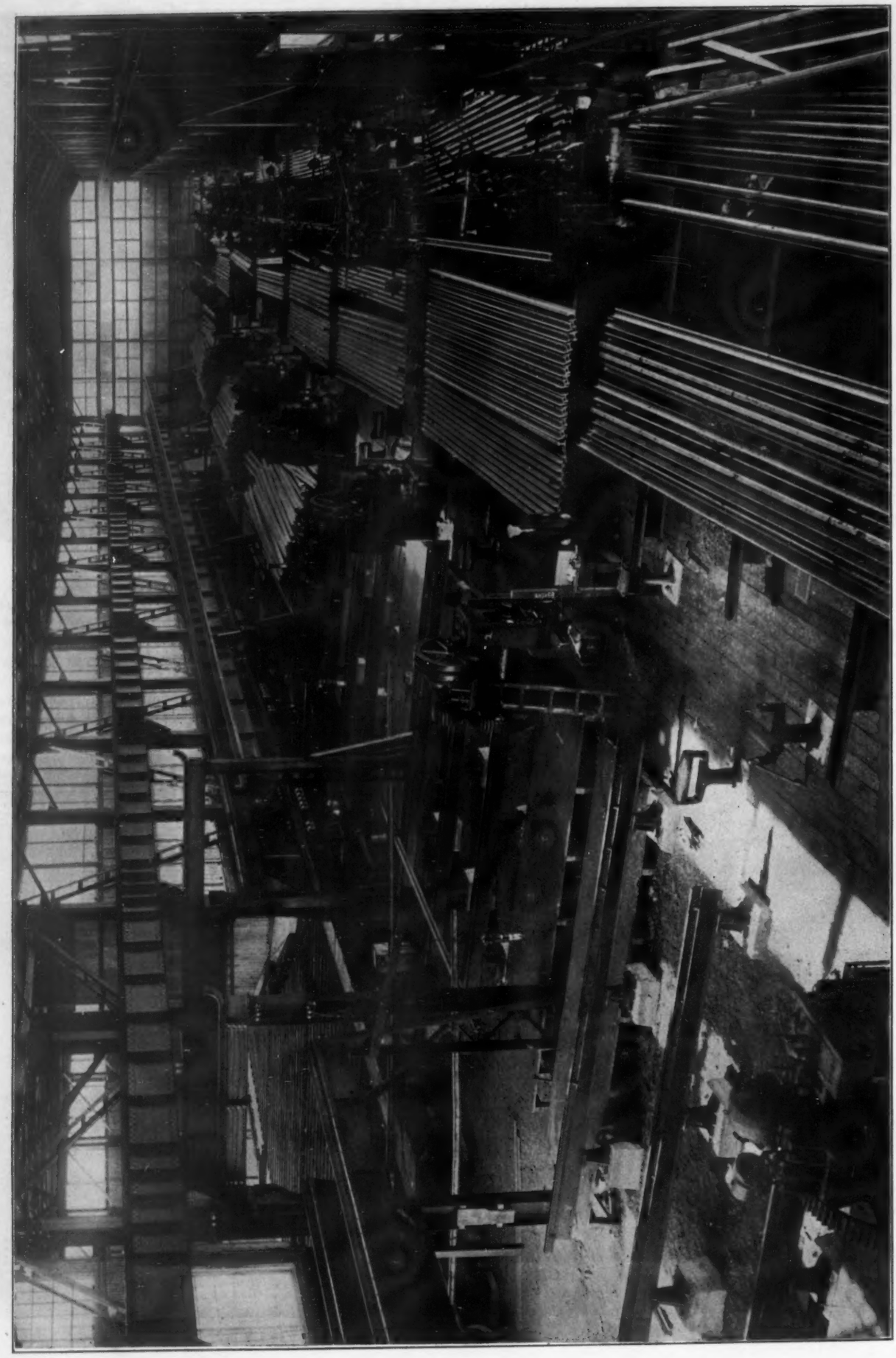

FIG. 6—THE RAIL MILL FINISHING DEPARTMENT

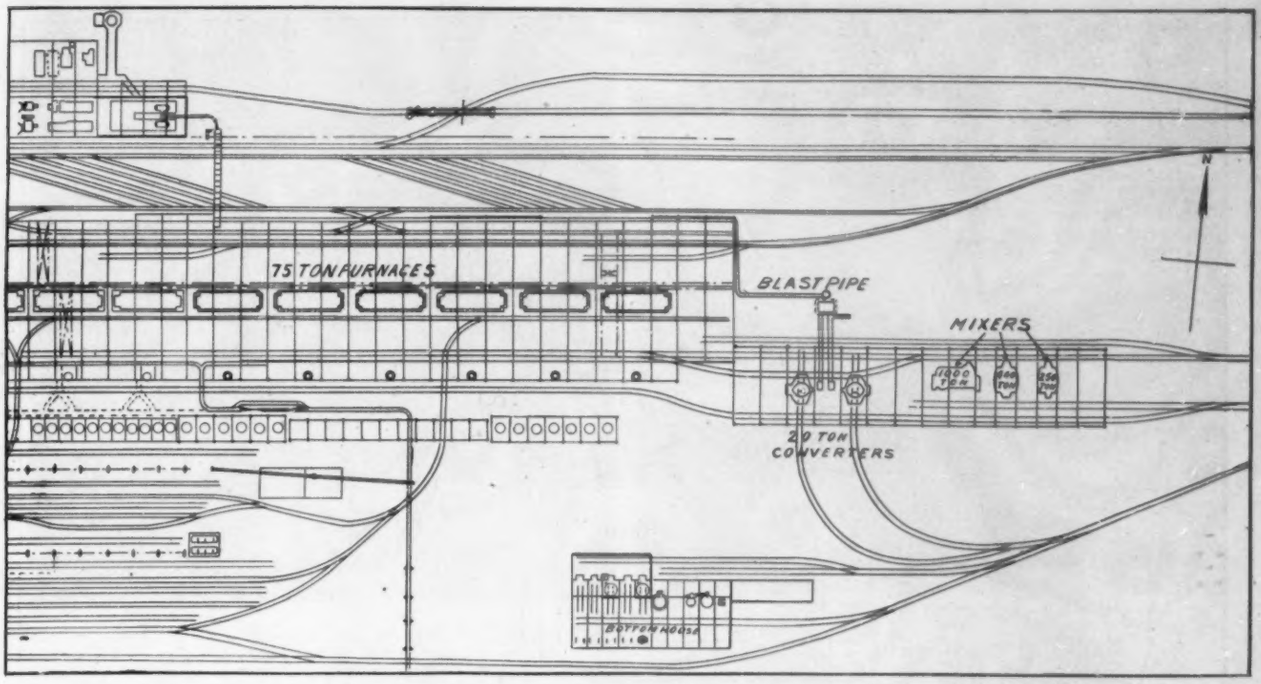

FIG. 7—LAYOUT OF NEW ADDITION TO SAUCON PLANT, CONSISTING OF SIX 75-TON OPEN-HEARTH FURNACES AND REBUILT AND ENLARGED BESSEMER AND MIXING DEPARTMENTS

units of this character, except that they are heavily bound with large steel beams and heavy slabs. Some improvement over the previous group of furnaces in the Saucon plant is shown in the valve arrangements. These valves are water-sealed and electrically-operated throughout. They were developed by the Bethlehem Steel Co. for its own purposes and in service have given excellent satisfaction. The new converter and mixing house is of brick and steel construction, 75 feet, 4½ inches between centers of columns and 373 feet, 4 inches long. The head room required for the largest mixer is 45 feet, 10 inches. The old Bessemer and mixing house was 65 x 200 feet. Its head room was 53 feet, 6 inches. The new Bessemer plant is equipped with two 20-ton converters which were removed from the former converter department. The converters are blown by a 46-inch and 84 x 84 and 60-inch Southwark cross-compound steam engine with barometric condenser. This engine is the same that was used in the former Bessemer plant.

If mixing facilities may be accepted as the measure of capacity for duplexing operations, the enlarged Saucon plant is one of the largest if not the largest plant of its kind in the country. In the Bessemer and mixing de-

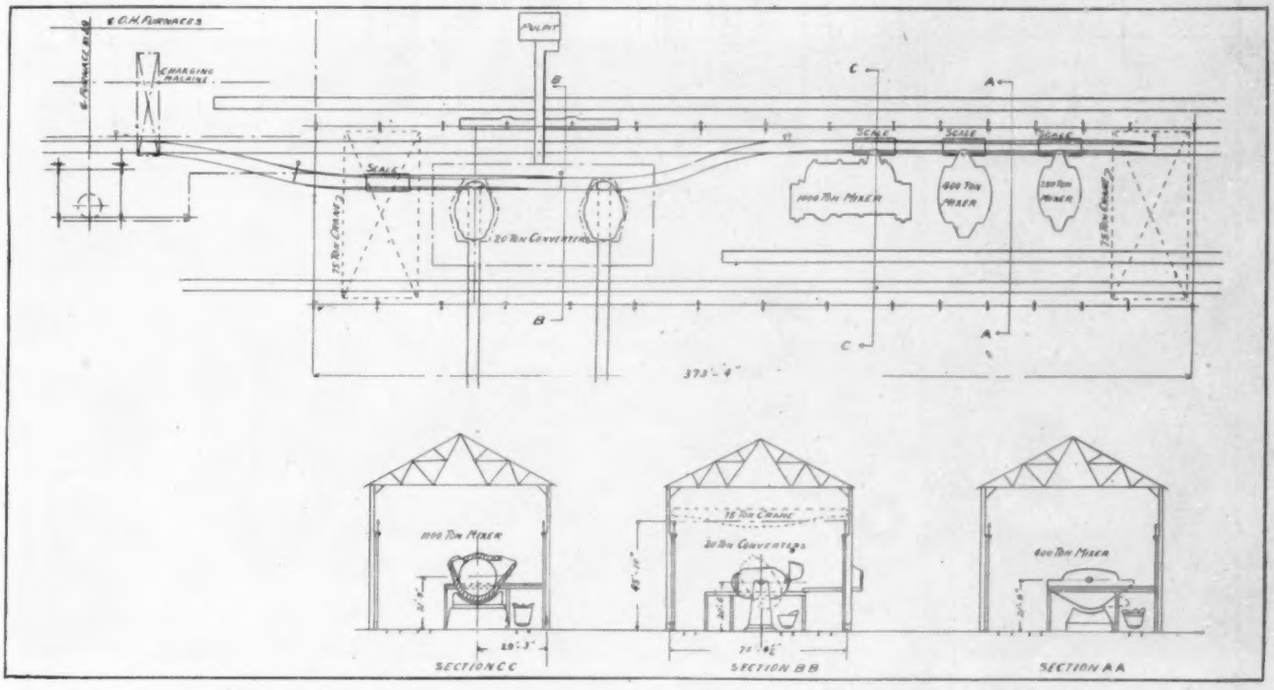

FIG. 8—ENLARGED LAYOUT OF THE BESSEMER CONVERTER AND MIXING DEPARTMENTS

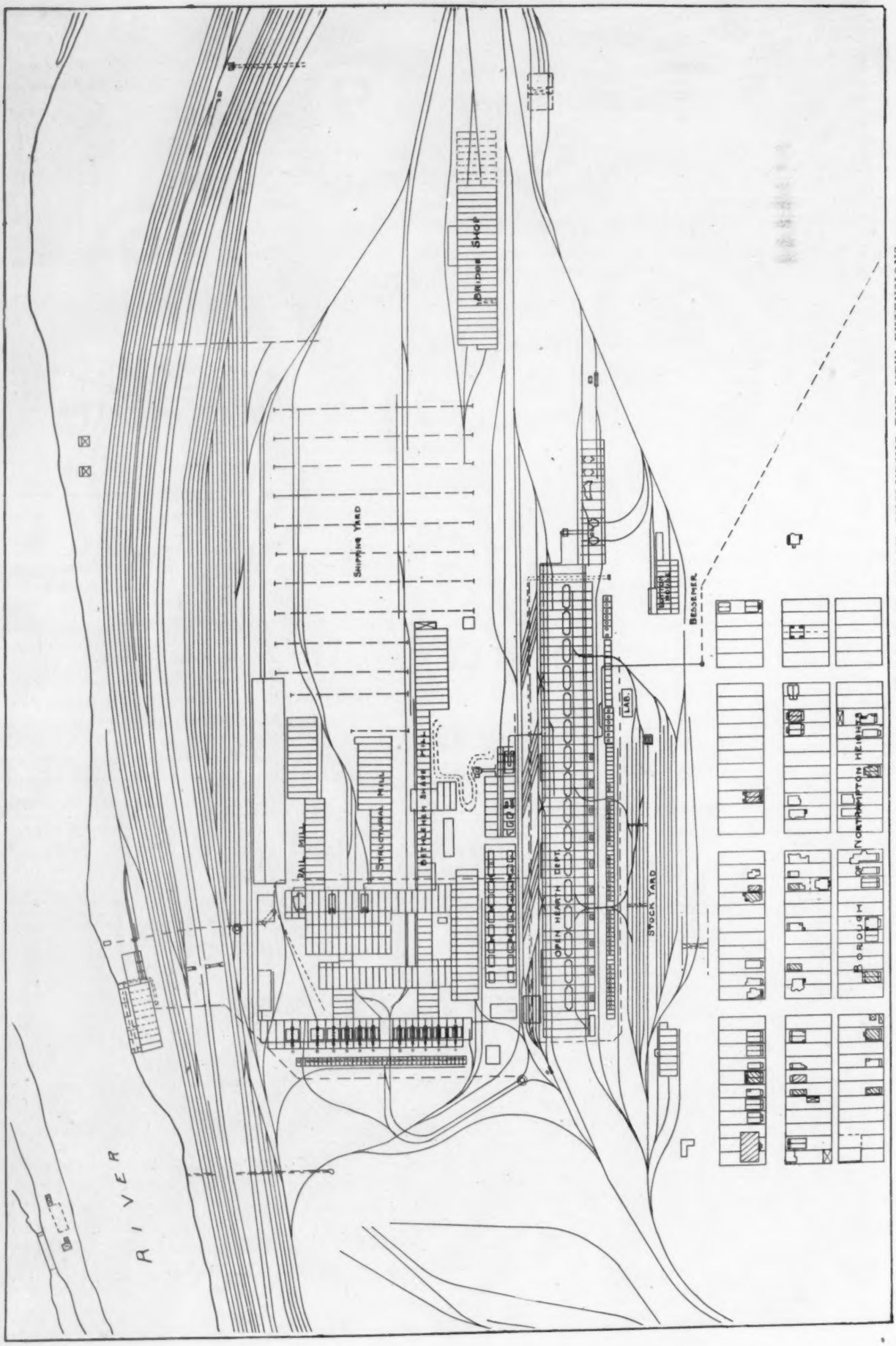

FIG. 9—GENERAL LAYOUT OF THE SAUCON PLANT AS IT IS TODAY, INCLUDING THE NEW EXTENSIONS

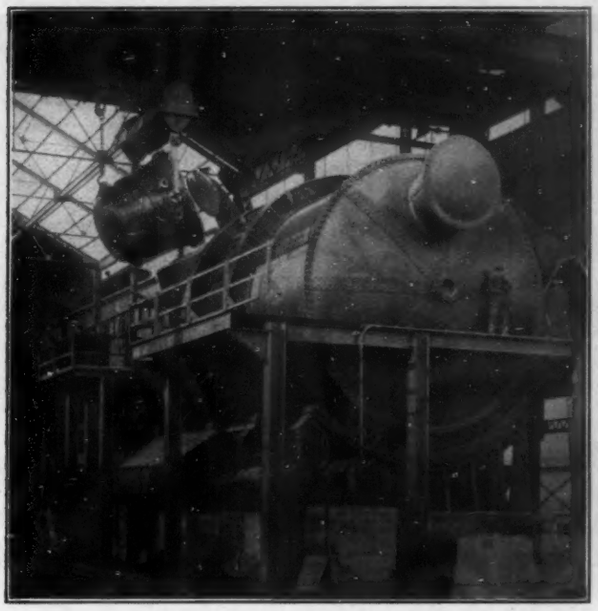

FIG. 10—THE 1,000-TON METAL MIXER RECEIVING A CHARGE OF IRON

FIG. 11—BESSEMER PLANT, SHOWING CONVERTER IN OPERATION

partment, is located one 1,000-ton, one 450-ton and one 250- ton mixer, a combined capacity of 1,700 tons. These capacities can be considerably exceeded if conditions demand. Just how much metal the largest mixer could contain at a given time has not been tested out, but it is believed it could accommodate 1,200 tons. This would require the filling of the mixer once for every 15 single casts of basic metal from the blast furnaces and the combined full content of 30 of the 40-ton ladle cars which deliver the molten iron. The 450 and the 250-ton mixers were removed from the former plant. The 1,000-ton mixer is new.

The most interesting feature of the plant is the 1,000-ton mixer. This is the largest unit of its type in the United States, and the first of its kind ever built in this country. The design of this giant vessel was developed and it was built by the Pennsylvania Engineering Works, New Castle, Pa. When the Bethlehem Steel Co. signified its desire to install a unit of so large a capacity, the Pennsylvania Engineering Works sent its engineers to Germany to study the design and general operations of several mixers of 1,000 to 2,000 tons capacity, which are being used in some of the larger works of that country. It has been recognized by steel works engineers in this country that the German steel masters have made great progress in extending their mixer operations. The result was the development of the type adopted by the Bethlehem Steel Co. in which the American engineers incorporated a number of original improvements over the European designs.

This mixer has a cylindrical body, which lies in a horizontal position. The molten iron is poured in at the

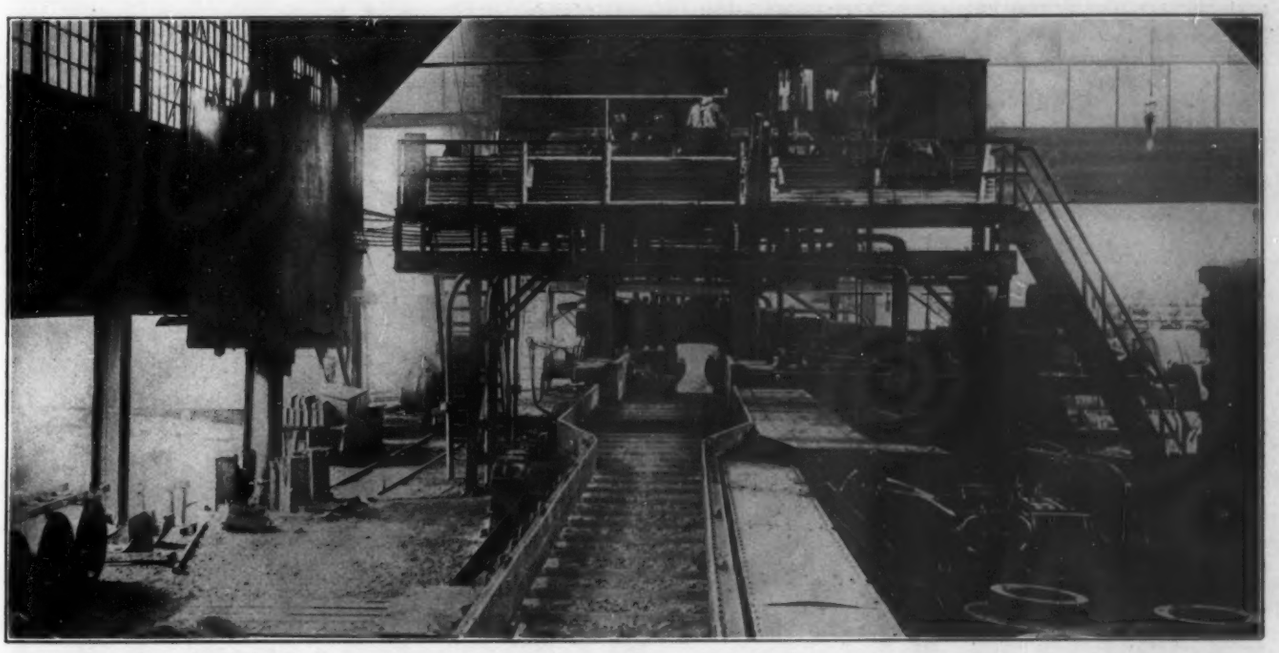

FIG. 12—FORTY-SIX-INCH BLOOMING MILL SERVING GREY UNIVERSAL MILL, SHOWING BEAM-SHAPED INGOT RECEIVING FIRST PASS

FIG. 13—THE GREY UNIVERSAL SHAPE MILL

side of one end and is tapped from the opposite side. The mixer has a considerably deeper bath than the average large steel works unit of this character. A view of the large mixer as installed at the Saucon plant is shown in Fig. 10. The mixer is operated by two 75-horsepower motors, furnished by the Crocker-Wheeler Co., either of which is capable of transmitting the required power to the vessel. These motors are operated by an Electric Controller & Mfg. Co.'s magnetic, switch type controller, which facilitates the return of the mixer at high speed to normal position. The motors are provided with a clutch gear so that if one should be disabled for any reason, the other can take care of the load. The use of a mixer of so large a capacity is that it insures more uniform metal. The mixer is heated by coke oven gas.

The cycle of duplexing operations at the Saucon plant, begins with the delivery to the mixer building of the molten pig metal from the Lehigh plant of the Bethlehem company. Blast furnaces are not operated in connection with the Saucon plant and it is necessary to bring the molten iron from the group of seven blast furnaces located about a mile and a half distant. These stacks form a part of the Lehigh works that constitute the other great division of the general Bethlehem plant beside Saucon. The Lehigh department occupies the western portion of the general works' site of the Bethlehem company, while the Saucon plant is at the extreme east. The mills and

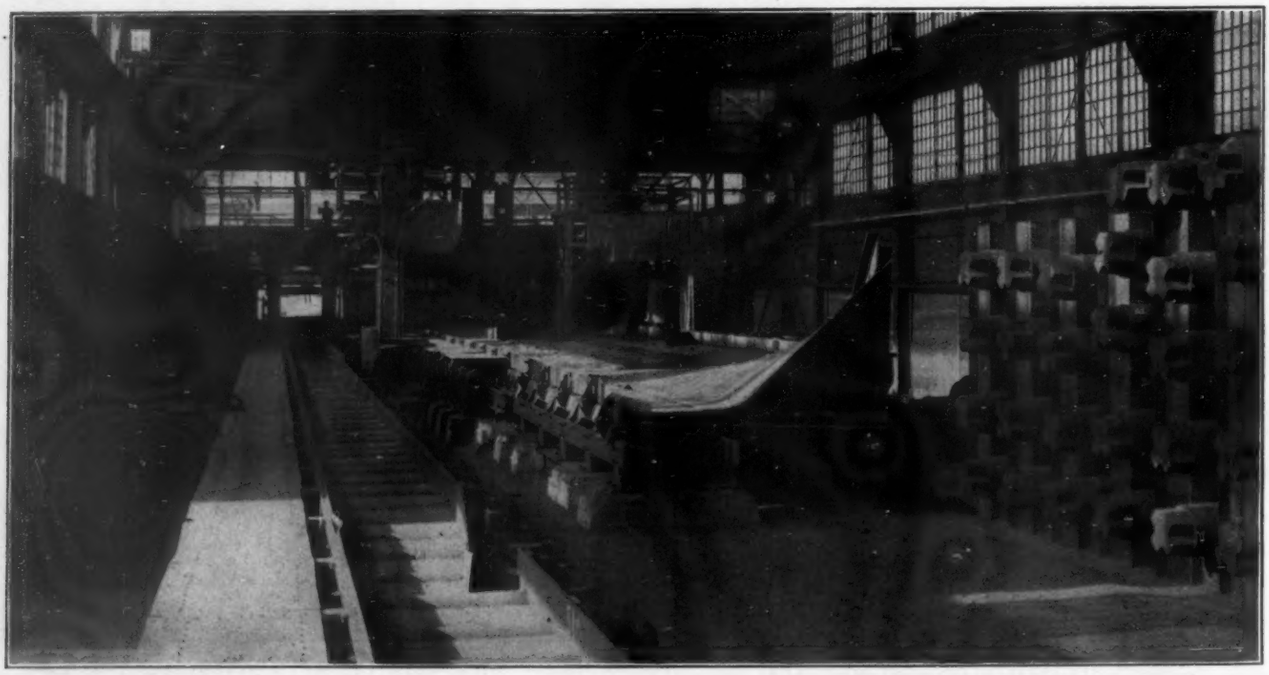

FIG. 14—TWENTY-EIGHT-INCH STANDARD SHAPE MILL

furnaces stretch along the Lehigh Valley railroad and the Lehigh river, a distance of more than two miles. The molten metal is transported by trains of 40-ton ladle cars, propelled by steam locomotives of the usual steel works type.

Entering the mixer building, the ladles are weighed on a 100-ton scale. Two 75-ton Alliance traveling cranes, with a 70-foot span, which are part of the new equipment of this department, lift the ladles from the cars and elevate them into position for discharging their contents into the mixer. The 1,000 and 450-ton mixers are regularly used to receive the molten basic metal. The 250-ton mixer is employed as a receiver for recarburizing iron which is of special Bessemer quality. This recarburizing agent is poured from the mixer into ladles as needed, and is added to the bath in the open-hearth furnaces. While the mixer and Bessemer department has fully equipped converters for use when duplexing, these are not self-contained Bessemer units. No cupolas have been installed in this department to melt spiegeleisen as would be required if Bessemer steel were to be produced. When the Bessemer converters were added to the Saucon works in 1911, they were intended exclusively for duplexing operations and still are so employed. From the mixers the metal is poured into ladles again and is charged into the converters.

Duplexing

The blowing of the metal in the Bessemer converters follows. After the iron has been partially desiliconized and decarbonized, it is poured from the converters into 25-ton ladle cars in which it is transferred by an electric locomotive over a broad gage track to the charging floor of the open-hearth furnaces. The track system is such that the ladles from the converter house enter the open-hearth building on the same track, paralleling the south wall, on which the charging machinery is operated. Two cars and two ladles are in constant service for the transfer of metal when duplexing.

The furnaces are served by three charging machines of the Morgan type, which include one low type machine, electrically-operated. The crane runways of the old open-hearth department have been extended through the new building and two Alliance 60-ton cranes, with a 70-foot span, command the charging floor. One of these has been installed recently. The hot metal is charged into the open-hearth furnace through a portable spout which is placed in position by the charging machine. The only cold charges that are used in duplexing at Saucon consist of scrap produced by the Bethlehem company. When duplexing, outside scrap is never used, although when operating by the straight open-hearth process some outside scrap is charged. The final duplexing operation takes place in the open-hearth furnaces. The average time of a heat by the duplexing process is about 4½ hours computed from the time the metal enters the converters. As compared with straight open-hearth practice, the time of making a heat is reduced from 60 to 70 per cent, and the tonnage from this plant is proportionately increased. Flexibility of output from fixed capacity also is provided as the open-hearth furnaces and the Bessemer units may be operated at capacity for duplex metal; part of both may be used for duplexing if desired, or all the open-hearth furnaces may be operated apart from the Bessemer plant by the straight open-hearth process. No Bessemer steel, however, can be produced with the present equipment.

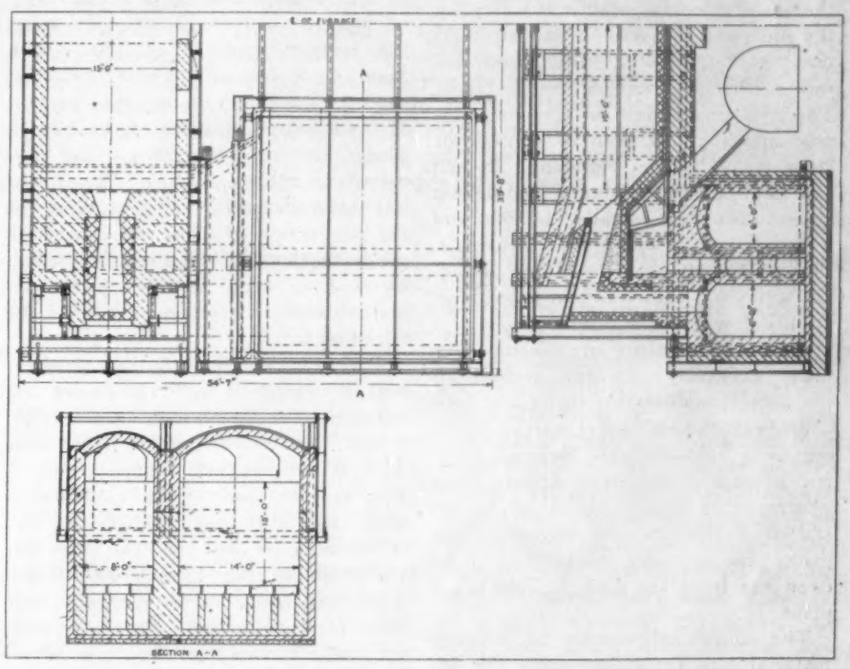

FIG. 15—SECTIONAL VIEWS OF 75-TON OPEN-HEARTH FURNACE

The steel is tapped into 100-ton ladles, this section of the open-hearth department being commanded by three 100-ton and one 125-ton Alliance cranes with a span of 59 feet 2½ inches. The 125-ton crane is new. The furnaces are served by 16, 7½-ton Sheppard jib cranes which are used for pulling spouts and other light duty. The ingots are cast from the 100-ton ladle by the lip-pouring method. The ingot buggies are of the 44-inch Treadwell type, which operate on a track that parallels the outside wall of the tapping side of the open-hearth building. When casting ingots for heavy beams, including 24, 26, 28 and 30-inch Bethlehem B and G sections, the ingots are roughly-shaped in the form of a beam, a special mold being used for this purpose. This facilitates the rolling of the steel into the wide flange sections upon the special Bethlehem shape mill. The Saucon plant is the only works in the country that rolls ingots of this type. For smaller beams, the standard form of ingot is used. In weight, the ingots vary from 14,000 to 21,000 pounds.

The ingot stripper is located at one end of the open-hearth building, and after the removal of the molds, the ingots are conveyed to the soaking pit building which extends at right angles to the open-hearth furnaces and the rolling mills. The general direction of the soaking pits is north and south, and of the open-hearths and mill buildings, east and west. The open-hearth building parallels the mills on the south. The soaking pit building is so arranged that the ingot buggies may enter at either end or at the center, on the side opposite the blooming mills. The ingots are heated in 11 pits of four holes each, which are fired by waste gas from the by-product coke plant of the Lehigh Coke Co., located nearby, and from which the Bethlehem company receives most of its blast furnace

fuel. The crane travel from the pits to the dump buggies serving the blooming mills is short. Three cranes of 10 tons capacity each are used for conveying the ingots from the pits to the mills. One of the cranes is of the Morgan type and two are Alliance.

The ingots are broken down on 40 and 46-inch blooming mills. The 40-inch mill blooms ingots for either the rail or the standard structural mill. The 46-inch blooming mill breaks down ingots exclusively for the 48-inch Grey universal structural mill. After the bloom passes from the 46-inch blooming mill, it is cropped at both ends by an 800-ton hydraulically-operated shear. The rail mill lies farthest north in the mill group and the special structural mill is at the extreme south. Between the two is the standard structural mill. Beyond the mills are the run-out and straightening tables, cooling beds, beam and rail yards, etc., and a bridge shop. The mill department at Saucon as it now appears, has been in service for some years. The blooming, 28-inch rail and special 48-inch Bethlehem shape mills were installed in 1906 and were placed in operation in August, 1907. The 28-inch, three-high standard structural mill was placed in operation a few months later.

The improvements at Saucon have made necessary the enlargement of the power facilities for this plant. An additional electric power unit, consisting of a 1,500-kilowatt General Electric generator, has been added. This generator is driven by a newly installed Bethlehem gas engine. This prime mover uses by-product coke oven gas from the Lehigh Coke Co.'s plant.

The additional output of finished material has made necessary the installation of increased finishing capacity to the already large beam yard. An additional crane runway has been provided and a specially designed motor-driven shear with tables, built by the Bethlehem Steel Co., has been installed. The need for an increased water supply has been met by the addition to the central pumping station of two 18,000,000-gallon pumps.

Lehigh Plant Extensions

In addition to the completed improvements of the Saucon plant, the Bethlehem Steel Co. is making extensions to its Lehigh plant. These consist of a blast furnace, open-hearth and electric furnaces for making alloy and tool steels, merchant mill and improvements to all of the existing departments. The appropriation for the improvements, including the Saucon plant extension, was $6,000,000.

In the blast furnace group of the Lehigh plant, furnace A, a new 22 x 90-foot stack with a daily capacity of 500 tons, is nearing completion and will be blown in in a few months. This furnace will be a duplicate of stacks D, E, F and G, and will be equipped with five 22 x 100-foot McClure stoves and an electrically-operated skip hoist. Furnace C of this group, a smaller stack, also is being remodelled. When stack A is completed, this plant will comprise five large and two smaller furnaces, with an output of approximately 1,000,000 tons of iron per year.

New Open-Hearth Plant

A new open-hearth plant, conisting of six 50-ton furnaces, is being erected upon a tract of 12 acres adjoining the western end of the Bethlehem Steel Co.'s works. This new steel capacity, together with the present 11 open-hearth furnaces of the Lehigh plant, will supply steel for the new merchant mill department. The plant has been designed and arranged for the production of alloy and other high grade steel. The steel-making capacity will be supplemented by the installation of an electric furnace of the Girod type.

The new merchant mill department will be equipped with a 35-inch reversing blooming mill, electrically-driven; continuous mill; four-stand 22-inch mill; 16 and 12-inch combination mill; 12 and 8-inch combination mill, and a 10-inch guide mill. All of these mills will be new, with the exception of the 12-inch and 8-inch mills, which are to be removed from their present locations. In their place are being erected new buildings to accommodate new 12, 10 and 8-inch hand mills, together with a full complement of annealing furnaces and other auxiliary capacity for the finishing of the output of the crucible and electric furnace departments.

The entire merchant mill equipment will be electrically-driven. The blooming mill will be driven by two Westinghouse motors in series and a motor-generator set consisting of one motor, two generators and a fly-wheel. This set is guaranteed to operate the 35-inch reversing blooming mill continuously, rolling the maximum possible tonnage consisting of 4 x 4-inch and 8 x 8-inch blooms, and will be guaranteed to reverse in two seconds. The motors for driving the various merchant mills will be of the General Electric type, ranging from 350 to 1,800 horsepower each. Some of these motors will be direct-connected to the mills. In other cases, they will be connected through a train of gears. Individual motors will be provided for the roughing and finishing mills, thereby eliminating belt and rope drives. To provide the additional electric power which will be required for driving the new mills, three 2,500-kilowatt General Electric generators, to be driven by Bethlehem gas engines, will be installed. Mackintosh-Hemphill & Co., Pittsburgh, will furnish the 35-inch blooming mill and the Morgan Engineering Co., Alliance, O., the blooming mill tables, manipulators and shear. For heating the ingots for the blooming mill, soaking pits will be added. Other finishing capacity consisting of cold-drawing and straightening machines, tempering and annealing furnaces, etc., are being provided.

Other improvements under way include the rebuilding of the puddling mill, erection of a new carpenter and pattern shop, the equipment of the former carpenter and pattern shop buildings as an additional machine repair shop, the enlargement of the iron and steel foundries and of the pattern storage facilities, additions to the drop forge department and an extension to the armor plate machine shop. The capacity of the armor plate and merchant forging departments is being increased and a large number of machine tools is being installed. New physical and chemical laboratories also are being built and a special building, of attractive design, has been erected for the accommodation of the government representatives stationed at the works for the inspection of material. The extensions to the Lehigh plant will be completed this year.

New Jersey Second in Zinc Production

Including the recoverable zinc content of the ore produced in New Jersey, the zinc produced in the state in 1912 amounted to 69,755 short tons, valued at $9,626,191, making the zinc-mining industry second in importance in the state and giving New Jersey second place as a producer of zinc, Missouri being first. The center of the zinc-mining industry in New Jersey is the famous Franklin Furnace district, in Sussex county, where mining has been carried on continuously for over 60 years.

Third among New Jersey's mineral industries is the manufacture of Portland cement, the production in 1912 having been 4,490,645 barrels, valued at $3,052,098.

West Looks Forward to Dawn of Better Days

Following the Declining Activity and Falling Prices of Recent Months —Tremendous Accumulation of Orders Kept Mills Busy Until July

By H Cole Estep[1]

THE TREND of the iron and steel market in the Chicago district during the year just closed was similar to that in all other parts of the country. Decreasing orders and falling prices were the leading elements in the situation and a study of the detailed quotations published herewith practically tells the whole story. Such a tremendous volume of business had accumulated during the latter part of 1912, that the influences on the market were not noticeably in evidence during the first half of the new year; until July 1, the mills and furnaces were strained to the utmost in catching up with long delayed deliveries. Specifications during the first half, although less than in 1912, were still equal to the capacity of the plants, but by the middle of the year the surplus tonnage had been worked off and the lean and hungry days loomed near. During the past six months, the iron and steel makers have been facing the struggle for existence in real earnest.

Conditions confronting the manufacturers and consumers of steel at the present time are not unlike those existing at the opening of 1911. Nevertheless, the west is proverbially optimistic and the minimum hand-to-mouth requirements of the country are so extensive that a total collapse of the industry is impossible. Previous depressions have been lived through successfully and although it may be necessary to exercise patience, the dawn of a better day cannot be far distant.

Pig iron was among the first commodities to feel the effects of the recession and buying began to be rather limited early in the spring. In the latter half of the year, there was a tremendous drop in the price of Lake Superior charcoal, due to special causes, accompanied by a rather unwonted display of strength on the part of southern foundry grades.

The year opened with local foundry iron quoted at $18, Chicago furnaces, and southern No. 2, $17.85, Chicago, equivalent to $13.50, Birmingham. Sales were slow, particularly for second quarter delivery, and prices began to move off late in February. By the middle of March northern iron had dropped 50 cents a ton and southern grades followed suit. The second quarter was simply a repetition of the first three months, bringing prices on July 1 down to $15, Chicago furnace, for northern No. 2 foundry and $14.85, Chicago, for southern No. 2. This was a net drop of $3 a ton during the first six months.

During April, coke shipments from the Connellsville district were greatly hampered by the tremendous floods in central Ohio and the lack of fuel was promptly seized upon as a pretext for cutting down production. When the flood situation was straightened out about May 1, the demand had shrunk so that none of the furnace interests seriously contemplated increasing its melt to its former proportions.

The second half opened with fair sales of all grades of pig iron, but the total tonnage was not sufficient to counteract the weakness in the market. It did, however, prevent further declines in the price of northern foundry iron until December. Southern producers had seen the hand writing on the wall and a large number of furnaces were blown out in the Alabama and Tennessee districts. Production was brought down to a point where it was below the decreased consumption. Prices gradually became firmer and actually advanced from $14.85, Chicago, in July, to $15.85 early in November. Since that time, however, conditions have become more critical and the market has lost all that it gained.

Lake Superior Charcoal

Early in the year, weakness developed in the quotations on Lake Superior charcoal and the situation became acute early in August. The phenomenally low quotations were due largely to the necessity for heavy sales by an important producing interest that has since found it necessary to liquidate. These sales were forced at a time when the outlet was limited, and in order to get rid of the desired tonnage, the producers were obliged to lower their quotations until they were equal to or under the prices on similar grades of coke iron. Charcoal prices stiffened slightly during the last quarter and the year closed with the Chicago market quotable at $15.50.

Finished materials followed the same course as the primary product, except that the price reductions were confined to the last half and the liquidation was somewhat more drastic than that experienced in the pig iron market. Steel bars have preserved a notable strength throughout the year and during two months were quoted in the Chicago market higher than shapes. This was due to several causes, among them being the comparatively limited capacity of the bar mills in the west. Also, the agricultural implement contracts were booked with some few exceptions at 1.40c, Pittsburgh, and both buyer and seller had a common interest in maintaining quotations. Early in the last quarter, however, conditions developed which made it illogical to further maintain bar prices on a parity with plates and shapes and heavy reductions took place. The year opened with bars quoted 1.63c and closed with the figures standing at 1.38c, a total reduction of $5 a ton. As previously mentioned, most of the agricultural implement contracts were placed on a basis of 1.40c, Pittsburgh, but there is now little doubt that some of the more important commitments were

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booked at $2 a ton under the prevailing quotation.

In January, plates and shapes were quoted at the same figure, namely 1.68c, Chicago, but along toward the middle of the year the falling off in

cago territory were busy until about Oct. 1; since that date, sharp curtailment in production has taken place. Early in the second half, it was confidently expected that heavy railroad orders would be received during the

A number of influences have combined to reduce scrap quotations in Chicago to figures lower than any heretofore recorded. At the close of the year, No. 1 railroad wrought was $8.50 per net ton, heavy melting steel

AVERAGE MONTHLY PRICES CHICAGO MARKET—1913

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Lake Superior charcoal pig iron.....	$18.25	$18.00	$18.00	$18.00	$18.00	$16.75	$16.75	$15.00	$15.00	$15.75	$15.50	$15.50
Northern No. 2 foundry pig iron.....	18.00	18.00	17.50	17.00	16.50	16.00	15.00	15.00	15.00	15.00	15.00	14.50
Southern No. 2 foundry pig iron.....	17.85	17.85	17.35	16.85	16.35	15.60	14.85	15.35	15.35	15.85	15.35	15.35
Bar iron, f. o. b. mill.....	1.60c	1.60c	1.60c	1.57½c	1.57½c	1.55c	1.50c	1.45c	1.35c	1.25c	1.15c	1.15c
Steel bars, f. o. b. mill.....	1.63c	1.63c	1.63c	1.58c	1.58c	1.58c	1.58c	1.58c	1.58c	1.53c	1.48c	1.38c
Structurals	1.68c	1.68c	1.68c	1.68c	1.63c	1.63c	1.63c	1.63c	1.63c	1.58c	1.48c	1.38c
Plates	1.68c	1.68c	1.68c	1.68c	1.63c	1.63c	1.63c	1.63c	1.58c	1.53c	1.43c	1.33c
Sheets No. 28 black, store.....	2.70c	2.90c	2.90c	2.50c	2.90c	2.90c	2.90c	2.80c	2.80c	2.75c	2.65c	2.65c
Plain wire, jobbers' carloads.....	1.73c	1.73c	1.73c	1.73c	1.73c	1.73c	1.73c	1.68c	1.63c	1.63c	1.58c	1.53c
Wire nails, jobbers' carloads.....	1.93c	1.93c	1.93c	1.93c	1.93c	1.93c	1.93c	1.88c	1.83c	1.83c	1.78c	1.78c
No. 1 R. R. wrought, net ton.....	$12.75	$12.25	$12.00	$12.25	$11.25	$11.25	$10.50	$10.50	$10.25	$ 9.75	$ 8.75	$ 8.50
Heavy melting steel, gross ton.....	12.75	12.50	12.50	12.50	12.00	12.00	10.50	10.50	10.50	10.50	9.00	9.00
Rerolling rails, gross ton.....	16.25	15.50	15.00	14.50	14.00	14.00	12.00	12.50	12.00	12.00	12.00	11.50

car specifications resulted in a pronounced weakness in the plate situation and the year closed with shapes generally held $1 a ton higher than plates. There was a fairly good volume of fabricating work during the year. The erection of large office buildings in Chicago was over stimulated in 1912 by a municipal ordinance limiting the height of buildings on which work commenced after a certain date, and as a result a reaction of more than usual proportions has been felt in steel construction in the immediate Chicago district.

Bar iron naturally followed the course of steel bars, but on account of the practical elimination of railroad business during the latter part of the

fall months. This hope was realized only partially. The Nickel Plate ordered 11,500 tons about Sept. 15; the Southern Pacific specified for 15,000 tons Sept. 25, the Great Northern ordered 20,000 tons early in October, and the Louisville & Nashville bought 47,500 tons in November. Most of the larger western systems persistently kept out of the market, waiting apparently for some of the eastern lines to take the lead.

The sheet and wire markets in Chicago usually follow the developments in the Pittsburgh district very closely and the year under review was no exception to the rule. The monthly quotations show a steady decline. Owing to the large number of inde-

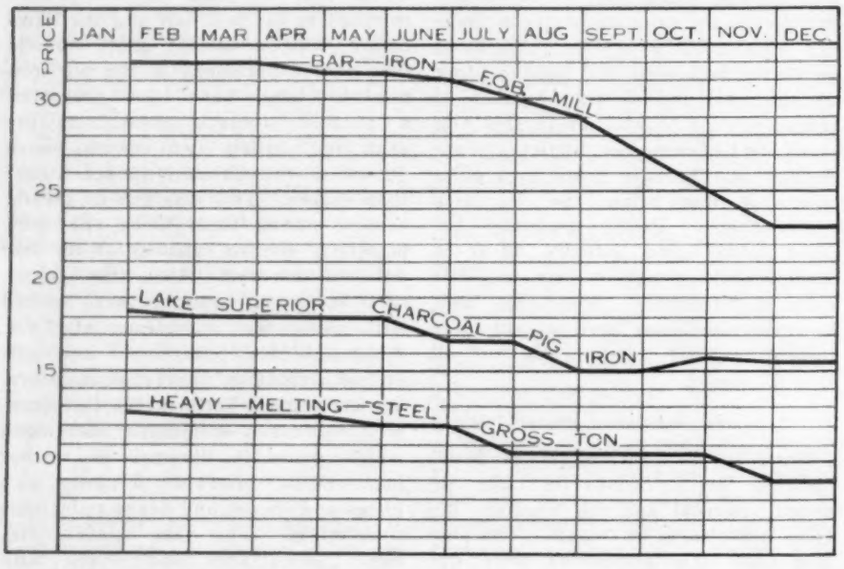


CHART SHOWING DOWNWARD TENDENCY OF BAR IRON, CHARCOAL PIG AND HEAVY MELTING STEEL AT CHICAGO

year prices dropped heavily to 1.12c, Chicago, in October, recovering later to a minimum of 1.15c.

The standard rail mills in the Chi-

pendent sheet mills, competition for this business has become unusually keen and the market is now entirely in the hands of the consumer.

$9 per gross ton and re-rolling rails $11.25 per gross ton. Quotations on the same items in January were $12.75, $12.75 and $16.25, respectively. The heavy decline in scrap is due not only to the general slowing down of business, but to a steadily increasing production. In other words, the amount of scrap available for reworking is growing proportionately larger year by year. The Chicago market was also adversely affected by the influence of some exceptionally large railroad accumulations, including a block of over 125,000 tons which has been held by the Santa Fe since the dull period of 1911. The weight of these accumulations effectively prevents any notable buoyancy in the Chicago scrap market. It is expected that most of the Santa Fe scrap can be worked off gradually, but it will probably take a couple of years or more to accomplish the task.

Nebraska's Mineral Industries

Nebraska has been termed "the state without a mine," and possibly within the strict interpretation of what constitutes a mine this statement may be true. The state, however, contributes to the total mineral production of the United States in the utilization of its clay deposits, the digging of sand and gravel, the quarrying of stone, the marketing of mineral waters, the manufacture of sand-lime brick, and the output of volcanic ash or pumice. In the production of pumice Nebraska ranks first among the states, with almost complete monopoly of the production, less than 1 per cent of the total output of pumice coming from other states. More than half of the total mineral production of the state is obtained from the clay pits, which in 1912 furnished products valued at $805,398 out of a total of $1,490,582.

Wheeling District Tin Plate Output Increased

Description of the Recently Completed Plant of the Wheeling Sheet & Tin Plate Co. Which Adds 1,000,000 Boxes to Production Per Year

THE tin plate producing capacity of the Wheeling district has been increased considerably by the erection of the Wheeling Sheet & Tin Plate Co.'s plant at Yorkville, O. The works have been built on a 45-acre tract overlooking the Ohio river, about seven miles from Wheeling, W. Va. The site is ideal, being 10 feet above the highest flood stage, and excellent transportation facilities are provided by the Wheeling & Lake Erie railroad and the Cleveland & Pittsburgh branch of the Pennsylvania lines west. Approximately 15 acres of the site are covered by the various buildings and sidings. The plant is arranged for 12 hot mills, 10 of which have been installed.

FIG. 1—HOT MILLS AND FURNACES IN THE WHEELING SHEET & TIN PLATE CO.'S PLANT

The Wheeling Sheet & Tin Plate Co., capitalized at $1,000,000, was organized in 1912 by Isaac M. Scott, formerly president of La Belle Iron Works, Steubenville, O. A number of years ago, he was identified with the Beaver Tin Plate Co., Lisbon, O., absorbed by the American Sheet & Tin Plate Co., with which he later became associated in an official capacity. S. Diescher & Sons, engineers, Farmers Bank building, Pittsburgh, designed and superintended the erection of the plant.

The works consist of three main buildings, two of which are brick-clad, steel frame, with composition roofs, while the hot mills are located in an all-steel structure. The building containing the machine and blacksmith shops, power plant and store room is 400 feet long, 42 feet to the centers of the crane rails with chord heights throughout, of 32 feet; the tin house is 400 feet long with a 32-foot span, and has a 15-foot lean-to; the bar house has a span of 75 feet, the hot mill building, 57 feet, the opening building 45 feet, and the annealing building 57 feet. Each of these structures is 400 feet long.

The sheet bar building parallels the hot mill, and the assorting building and warehouse parallel the tin house. Raw material, in the form of sheet bars, is brought into the bar house in railroad cars, being unloaded on skids arranged throughout the bar mill building, from which they are carried by a 20-ton crane to the bar shear, where they are cut to desired lengths and piled on portable racks for delivery to the furnaces.

The engines driving the hot mills are located in the opening building where one white and two black picklers have been installed. The cold mills are equipped with conveyors and the annealing furnaces are fired with the American underfeed stoker. At one end of the plant is a transfer track, which extends through and across all buildings, facilitating deliveries to all departments. Primarily, the transfer cars are used for carrying material from the white pickler to the tin house, but the system serves for carrying black plate, ready for shipment, to the warehouse; when occasion demands, machinery requiring repairs can be transported direct to the machine shop from any department of the plant. The transfer cars have a capacity of 20 tons each and operate on a standard gage track, by being propelled by an electric locomotive of the Westinghouse-Baldwin type. To permit the electric locomotive to operate on any of the tracks, it is equipped with storage batteries, but when operating on the transfer track it receives its current from electric conductors between the tracks.

The tin house equipment consists of four 66-inch, seven 72-inch and four

80-inch machines, provided with catching and conveying devices of special design which carry the plates into the polishers. After being assorted, the plates are boxed, assorted, and, if desired, can be carried on trucks to railroad cars in the leanto of the warehouse.

The hot and cold mills were furnished by the Wheeling Mold & Foundry Co., Wheeling, W. Va. The housings are cast steel, each weighing 30,000 pounds, and are equipped to accommodate 30-inch diameter rolls, in the event that it is decided to replace the present 28-inch rolls. There are three trains of cold mills, the rolls being 26 inches in diameter, arranged in tandem and driven from a gear train.

Ten sheet and pair furnaces, designed and built by the George J. Hagan Co., Pittsburgh, have been installed. The stacks for these furnaces are located outside the building and are connected to the furnaces by underground flues. The floor space occupied by one sheet and pair furnace is, including ash pits, 20 feet by 20 feet 9 inches.

The eight box annealing furnaces are of the Hagan, stoker-fired type, built in batteries of two, each occupying a floor area of 36 x 23 feet with capacity for four 5-ton pots in each compartment.

The hot mill engines are of the single cylinder, horizontal, double-ported Corliss type, and were furnished by the Bass Foundry & Machine Co., Fort Wayne, Ind. The cylinders are 32 inches in diameter, with 60-inch stroke. They operate at 75 revolutions per minute and are arranged for rope drive. The flywheels are 20 feet in diameter and weigh 75,000 pounds. The rope wheels are 9 feet 3 inches in diameter and are grooved for 28 2¼-inch ropes. The main bearings are 19 x 38 inches. The shafts are 23 inches in diameter between the main and outboard bearings. With each engine is provided a jack shaft on which is mounted a rope wheel 24 feet in diameter, grooved for 28 2¼-inch ropes. This jack shaft is operated from the 9-foot 3-inch rope wheel of the engine shaft and there is a steel clutch coupling on one end of the jack shaft to which tne roll train is connected. The jack shaft pillow blocks are exact duplicates of the engine outboard pillow blocks, making all the parts interchangeable.

The cold mill engine is similar to the hot mill engines, and operates at 50 revolutions per minute. It is equipped with a gear pinion on the main shaft which operates the gear train driving the stands of cold rolls.

The boiler plant is equipped with four 500-horsepower vertical water tube boilers, arranged with dutch oven settings. Each boiler is suspended from an independent framework, so arranged that each tube can be readily removed. Coal is received on an elevated track, 15 feet above the floor of the boiler house, and is stored in pits. Two 1,000,000-gallon Wilson-Snyder pumps are located in the pump house at the north end of the boiler house. Water is pumped to a 100,000-gallon elevated tank, 100 feet high, which is near the south end on the main building.

The steam mains parallel the length of the boiler house, extending through the south wall of that building into the power house; the mains are suspended from the trusses of these buildings. The main steam line extends underneath the floor of the power house, through a tunnel to a large receiver, located in a pit between the two hot mill engines. All steam lines extending from this receiver to the other engines are carried underground. The exhaust lines are led underground, rising up to the Colles heaters, the free exhaust lines passing between the crane girders of the opening and the annealing buildings. The pipes carrying feed water to the Wilson-Snyder pumps pass through the steam tunnel back to the boiler house. Steam is supplied to the power house and blacksmith shop from the main steam line before it passes into the tunnel. Electric power is generated by two 200-kilowatt units.

Coal for the sheet and pair furnaces is stored in a pit underneath the elevated track, located between the power and boiler houses. An underground conveyor delivers the fuel from this pit to a pit in the bar house from which it is distributed to the sheet and pair furnaces in buckets carried by the bar house crane, which also conveys the ashes from these furnaces to a siding in the bar house where they are loaded into cars. Coal for the annealing furnaces is discharged from cars on a track paralleling the annealing house.

Current for motors throughout the plant, for lighting and general power purposes, is furnished by two 200-kilowatt, 250-volt Westinghouse generators, direct-connected to 18 x 19-inch single valve side crank engines, built by the Ames Iron Works, Oswego, N. Y.

The bar shears together with their tables, furnished by the United Engineering & Foundry Co., Pittsburgh,

FIG. 2—ANOTHER VIEW OF THE MILLS FROM THE CATCHER'S SIDE

FIG. 3—HOT MILL ENGINE, SHOWING ROPE DRIVE

and the doubling and squaring shears, furnished by the Wheeling Mold & Foundry Co., are operated by Westinghouse motors. The bar shears are designed to cut six sheet bars at a time. The tinning machinery, furnished by the Elwood Iron Works, Elwood, Ind., also is motor-driven. The tin pots, furnished by the Elwood company, have a capacity of 1,750 base boxes per week.

Piping Equipment

The piping system was furnished by the Best Mfg. Co., Pittsburgh. The steam specialties in the general piping layout consist of separators, manufactured by the Austin Separator Co., Detroit; pump governors, manufactured by the Murray Specialty Mfg. Co., Detroit; steam traps and high and low water alarms, manufactured by the Wright Mfg. Co., Detroit, and non-return valves, manufactured by the Safety Equipment Mfg. Co., Chicago Heights, Ill.

The plant is commanded by seven traveling cranes, all but two of which are of 20 tons capacity; cranes in the tin and assorting house are of 5 tons capacity each. The cranes were furnished by the Cleveland Crane & Engineering Co., Wickliffe, O.

Careful attention was given to the ventilation and lighting of the plant. At night, the plant is illuminated by Tungsten lights, suspended from the crane columns, roof trusses and brackets; outdoor illumination is provided by cluster lights supported by brackets attached to the buildings. The Mutual Electric Co., Wheeling, furnished the main switchboard in the power house and the numerous distributing boards in various parts of the plant.* A wide monitor ventilator, provided with Lupton metal sash and operating devices, extends along the top of the tin house roof the entire length of this building. All of the stacks are located outside the buildings, and waste gases pass from the furnaces to the stacks through underground flues. Waste gases from the furnaces under the tinning pots, which is the only equipment fired with natural gas, pass off through one stack, serving all the pots.

Fan for the Tin House

The palm oil, bran and tin storage and a large wash room for employes are located in a building between the tin and annealing houses. The heating and ventilating plant adjoins the tin vault and is equipped with a fan of 80,000 cubic feet capacity, sufficiently large to heat and ventilate the tin house and assorting department. Exhaust steam from the cold and hot mill engines passes through mains in an underground tunnel and

FIG. 4—THE COLD MILL DRIVE

through a bank of tubes at the suction end of this fan where the air forced by the fan into the tin and assorting houses is heated and distributed along the walls of these departments through galvanized steel conductors.

The structural steel was fabricated by the Fort Pitt Bridge Works, Pittsburgh, and the Lawrence Steel Construction Co., of the same place, standard, self-supporting type, built by the Mesta Machine Co., Pittsburgh. Four-arm picklers are used for the black pickling and three-arm for the white pickling.

Five of the hot mills were placed in operation about the middle of December, and the other five will be in service shortly after the first of the year. When operating at 12-mill capacity, the plant will have an annual

South Dakota's Gold Production Increases in 1912

Gold mining in the Black Hills of Lawrence county is the principal mining industry of South Dakota, the gold produced representing more than 90 per cent of the total mineral production of the state. In the production of gold South Dakota ranks fifth among all the states. In 1911 the

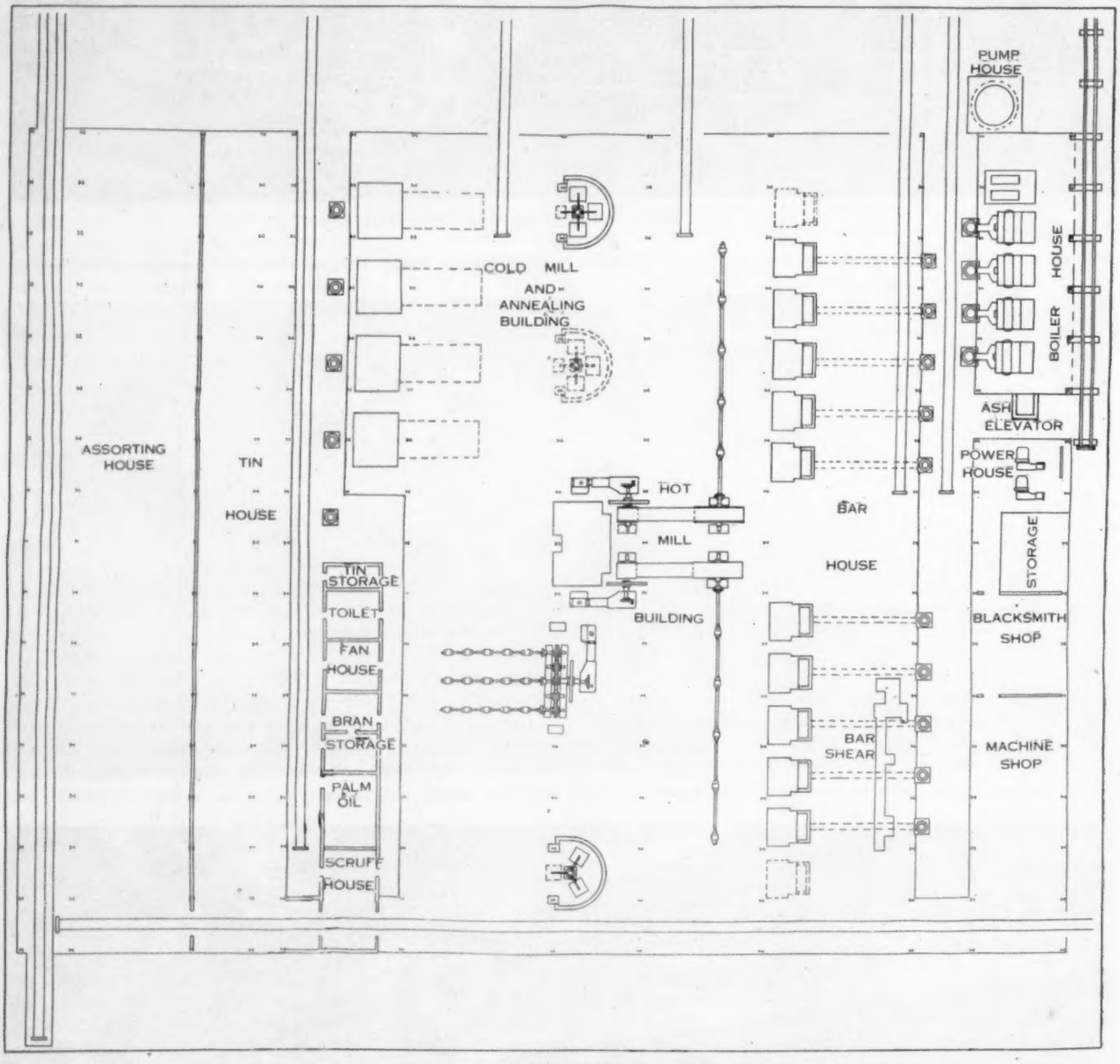


FIG. 5—GENERAL PLAN OF THE WHEELING SHEET & TIN PLATE CO.'S PLANT

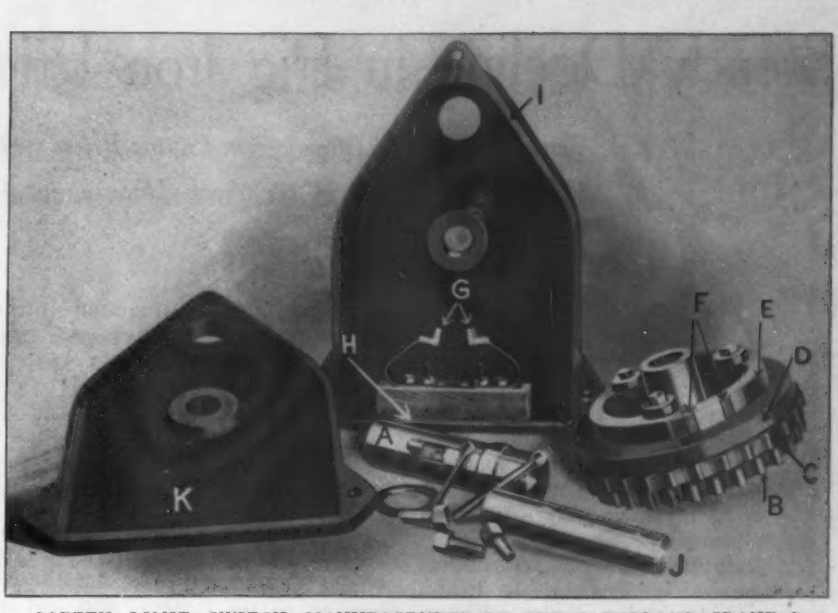
erected the buildings. Metal windows and operating devices were furnished by the David Lupton's Sons Co., Philadelphia; skylights and gutters, by the Thomas W. Irwin Co., Pittsburgh; the Wilson-Snyder Mfg. Co., Pittsburgh, furnished the pumps, and the Hyde Park Foundry & Machine Co., Hyde Park, Pa., furnished the roll lathes. The picklers are of the output of approximately 1,000,000 boxes of tin plates. The officers of the company follow: Isaac M. Scott, president; F. W. Henderson, secretary and treasurer; and E. T. McNulty, general superintendent.

The Reemsnyder Spike Co., Canton, O., has changed its name to The Reemsnyder Co.

production of gold, most of which came from the Homestake mine in the Black Hills region, amounted to 359,904 fine ounces, valued at $7,439,874. In 1912, the production amounted to 381,745 fine ounces, valued at $7,891,370. The total value of the mineral products of South Dakota was $8,047,259 in 1911 and increased to $8,436,240 in 1912.

Safety Limit Switch

A safety limit switch, designed for service on any type of crane, now is being manufactured by the Cleveland Crane & Engineering Co., Wickliffe, O. A limit switch, to perform its essential function of protection in the case of careless operation, should be so constructed and connected to the hoisting motor circuit that it always will be in operating condition when required. In designing this switch, every effort was made to meet this condition and it is so connected into the hoist motor circuit that the electrical operating parts always are charged with current when the hoist is in operation. In the event of a broken wire or loose connection, the motor is immediately thrown out of commission in the same way as though the hoist had been run to the limit point. The parts of this switch are shown in the accompanying illustration. The tripper, *A*, is connected to the end of the hoisting drum shaft by two pins, and four holes drilled in the end of the tripper allow for one-quarter turn positive adjustment. A tooth at the end of the tripper engages one tooth of the tripper sprocket, *B*, at each revolution of the drum. An oval recess cut at the side of the tooth in the tripper permits the check sprocket, *C*, to rotate while the tripper tooth is engaged in the tripper sprocket. The conformation of the teeth on the outside of the check sprocket to the radius of the tripper prevents the sprocket wheel from turning while the tripper is completing the revolution.



SAFETY LIMIT SWITCH MANUFACTURED BY THE CLEVELAND CRANE & ENGINEERING CO.

Attached to the sprockets by small insulated through bolts is a fiber insulating ring, *D*, and a brass contact ring, *E*. In the brass contact ring two fiber contact blocks, *F*, are inserted, the distance at which they are separated depending upon the number of revolutions the drum makes in allowing the hoisting block to travel between the two extremes of position. Mounted on the fiber block, *H*, are two contact springs, *C*. The circuit leads are attached to terminal posts of the contact spring and are connected to the coil of a magnetic switch, which carries the motor current, located in the cage within easy reach of the operator. When the block reaches the limit of travel, the switch is opened by the breaking of the circuit in the switch coil, due to the contacts, *G*, resting on the fiber blocks, *F*. The entire mechanism is enclosed in a cast iron box, *I*, and is attached to the frame of the trolley by through bolts. One end of pin, *J*, which carries the contact ring and sprockets, is held by a bearing in the box and the other by a bearing in the cover, *K*. The tripper pin is held in place in the same manner. When the cover is removed from the box, every part of this device is accessible, and owing to its small size, the switch can be installed readily.

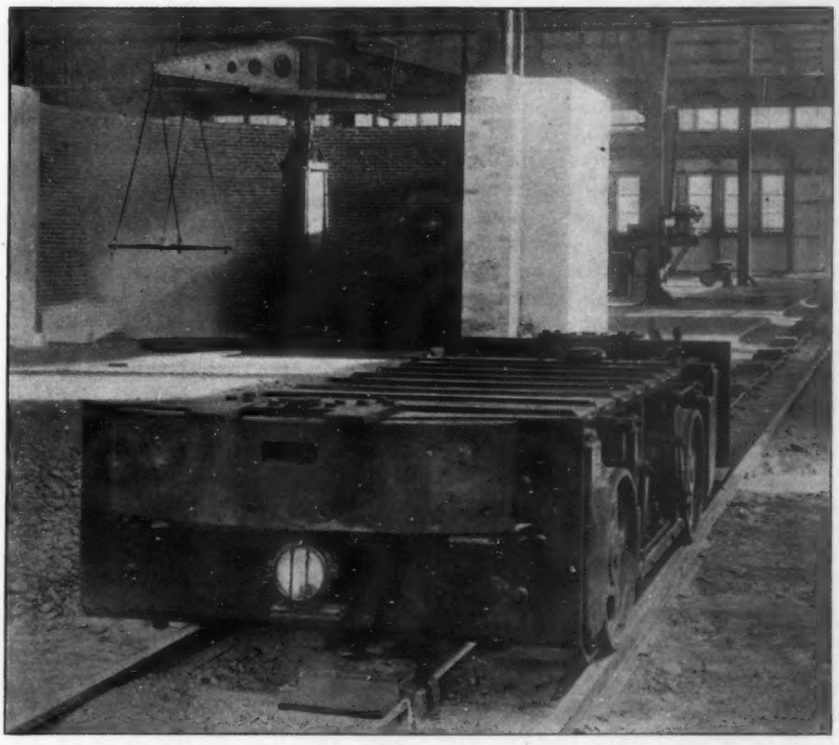


FIG. 6—TRANSFER LOCOMOTIVE, SHOWING SYSTEM OF ELECTRIC CONDUCTORS WITH PICKLING MACHINE IN THE BACKGROUND

Alaska's Coal Development Retarded

The development of the coal resources of Alaska, according to a statement in a report on the mineral resources of the United States issued by the United States Geological Survey, has been retarded on account of the lack of legislation permitting the exploitation of the known extensive and valuable fields. In 1912 the commercial product of coal in Alaska amounted to only 355 tons. In addition, 900 tons were mined under the direction of the Bureau of Mines for testing by the United States Navy. The imports of coal into Alaska amount to about 100,000 tons annually, but most of the transportation and manufacturing industries of the territory now depend on California oil for their fuel.

Steady Decline in Pig Iron Prices at Cincinnati

Tennessee Furnaces Often Led in Cutting Prices—Stocks Not Large Considering Dullness of the Year—Uncertainty as to the Future

By S G Backman

THE Cincinnati pig iron market was chiefly characterized during the past year by light inquiries and sales, and by an apparent lack of interest on the part of most of the buyers, with the result that an almost unbroken series of declines took place in regards to minimum prices on both southern and southern Ohio irons. This was almost a direct reversal of the market of 1912, during which year there was a gradual advance in prices with but one decline in either of the producing districts. In 1913 there was a gradual decline in prices with no advances in the southern Ohio market, and but four temporary advances in the southern market.

At the beginning of 1913, the outlook was rather encouraging, for the close of 1912 had been marked by a fair buying movement and a good demand. Prices were also fairly strong, and a number of furnaces were not actively soliciting business, but showed an indifference as to whether or not they sold any iron at the quotations prevailing at that time. Soon after the first of the year, however, the demand for practically all grades of iron fell off to almost a minimum, principally because a large number of melters in this territory had contracted for their first half requirements during the last quarter of 1912. A few of the furnaces, therefore, generally from among those in Tennessee, began secretly to underbid the market in an effort to stimulate buying, and this custom prevailed throughout the entire year. Holders of small lots of resale iron also occasionally offered certain tonnages at better than market prices, but these were limited as to grades and sizes, and did not always have much of an effect upon conditions in general. The offering of iron at lower prices, however, did not at any time bring out any large volume of buying, except when southern iron declined to $10, Birmingham basis, during the latter part of June, at which time about 50,000 tons were sold within eight or ten days. This was also the low point regarding prices of southern iron during the year. The low point of southern Ohio iron came about the middle of December, when $13, Ironton basis, for No. 2 foundry was the general quotation.

Prices at times were very uncertain, because of the secret manner in which some of the furnaces occasionally offered iron at lower than market figures. This pertains especially to minimum quotations for prompt shipment, throughout both the south and southern Ohio. Transactions that could have been used as tests or a basis of comparison were also generally lacking. Melters, therefore, because of this uncertainty, usually bought only in small lots for nearby shipment as requirements actually demanded, as they did not care to chance buying very far ahead on a declining market. They accordingly played the waiting game throughout the year, and had the situation fairly well in hand at all times.

The southern market especially appeared strong at the beginning of 1913, and there were then no indications of the somewhat serious set-back that it experienced throughout the year. At the conclusion of 1912, southern No. 2 foundry iron was quoted at from $13.50 to $14, Birmingham, for prompt shipment, and at from $14 to $14.50, Birmingham, for first half delivery. These prices were also somewhat general, and included both Alabama and Tennessee makes. The feeling among both the buyers and sellers was also very good and some of the furnace operators, especially a few in Alabama, were none too anxious to sell for contract shipment, as they felt that there was a possibility of the narket becoming stronger before the end of january. The first two weeks in 1913, however, were disappointing from the operators' point of view. Inquiries during this period were very light and the tonnage booked was far below the amount expected by sellers, with the result that about the third week in January the minimum price of southern No. 2 foundry iron dropped from $14, Birmingham basis, to $13.50, for spot and first half shipment. This high level of $14 as the minimum quotation was never regained during the year, but instead, in December, 1913, the prevailing minimum price was $10.50, Birmingham basis, making a decline of $3.50 a ton from January to December. This decline was steady and gradual with the exception of early in August and late in November, when slight temporary advances were made, the latter, however, being more of a flurry than anything else.

The low sellers during the year were usually the Tennessee producers because of freight differentials from furnaces in that state to certain parts of the Cincinnati territory. These stacks were also usually the first to reduce prices with probably one exception, when the Woodward Iron Co., Birmingham, quietly offered a large block of iron at a basis of $10, Birmingham, for No. 2 foundry, during the latter part of June. This price was about 75 cents below that of the general market, and marked the low level of southern iron for the year. A slight advance occurred after about eight or ten days, but during that short period the best buying movement of the year was realized, and it is estimated that about 50,000 tons of iron were sold within that time. Early in July, the minimum price was advanced to $10.25, Birmingham basis, and a week later to $10.50, Birmingham, as this company had by this time apparently taken all the tonnage it desired at this figure, and practically withdrew from the market. The general level was therefore shifted back to that at which the other furnaces were holding, as only one or two Tennessee producers followed the Woodward Iron Co. to the basis of $10,

(*Continued on page* 110.)

Great Increase in Steel Works Capacity in 1913

Sixty-Two Open-Hearth Furnaces With a Rated Annual Capacity of Over 3,000,000 Tons Placed in Operation and 40 Units Are Under Construction

By R V Sawhill

THE surprise occasioned two years ago by the announcement that the production of steel ingots and castings had exceeded, for the first time, the total output of pig iron, has since deepened into the conviction that the relative positions of the country's pig iron and steelmaking capacities have been reversed. Where the practice formerly held of estimating the steelmaking capacity of the country by deducting a comparatively fixed per centum from the pig iron capacity, it is now necessary to add to the latter figure a proportion that is rapidly increasing. The pig iron producing capacity of the country is estimated elsewhere in this issue at 35,000,000 tons annually. This figure takes into consideration blast furnaces that could operate under good market conditions, but ignores those furnaces that could not make iron at a profit unless prices reached a level considerably higher than any attained in recent years. In 1912, the production of steel castings and ingots was 31,250,000 tons, while the output of pig iron was 29,725,000 tons. Steel production thus exceeded that of pig iron by 1,525,000 tons. In 1911, the difference was only 27,000 tons in favor of the steel makers, while in the four preceding years, pig iron production had surpassed that of steel by from 1,200,000 tons to 2,400,000 tons.

The production of pig iron in 1913 was between 30,800,000 and 30,900,000 tons, and if the steel output maintained its 1912 ratio last year, the total would be about 32,500,000 tons. The steelmaking capacity of the country was more fully employed during 1913 than was the blast furnace. Of the 4,000,000 tons of blast furnace capacity that remained idle last year, it is logical to assume that the larger proportion was among the merchant furnaces. At first sight, it would seem that with this capacity in blast, pig iron production would again assume pre-eminence over steelmaking output, but this fails to take into consideration the wonderful increase in steelmaking capacity as shown by the number of open-hearths completed during 1913.

Open-Hearth Steel Furnaces Completed During 1913.

Company.	No. of furnaces.	Rated capacity, tons.	Estimated annual production, tons.
Allegheny Steel Co.	1	75	50,000
Alton Steel Co.	2	40	50,000
American Sheet & Tin Plate Co.	2	40	50,000
American Steel & Wire Co.	1	65	40,000
Bethlehem Steel Co.	6	75	300,000
Brier Hill Steel Co.	7	75	350,000
Carnegie Steel Co.	14	75	700,000
Carnegie Steel Co.	2	60	75,000
Inland Steel Co.	4	60	150,000
La Belle Iron Works	1	60	38,000
*Lackawanna Steel Co.	2	200	480,000
Pittsburgh Crucible Steel Co.	8	60	300,000
Republic Iron & Steel Co.	2	65	80,000
John A. Roebling's Sons Co.	3	40	75,000
The Falk Co.	1	25	22,000
Youngstown Sheet & Tube Co.	6	100	360,000
Totals	62		3,120,000

Open-Hearth Steel Furnaces Building at End of 1913.

Company.	No. of furnaces.	Rated capacity, tons.	Estimated annual production, tons.
American Iron & Steel Mfg. Co.	4	50	125,000
Bethlehem Steel Co.	6	50	185,000
Corrigan, McKinney & Co.	8	..	450,000
Lackawanna Steel Co.	4	60	150,000
Leetonia Steel Co.	2	70	85,000
Lukens Iron & Steel Co.	1	50	30,000
Minnesota Steel Co.	10	75	500,000
*Pennsylvania Steel Co.	2	75	180,000
Pennsylvania Steel Co.	1	75	50,000
Pittsburgh Crucible Steel Co.	2	60	75,000
Totals	40		1,830,000

*Furnaces operated in connection with duplex process.

The accompanying table shows that 62 open-hearth furnaces, with an estimated capacity of 3,120,000 tons were completed last year. In 1912, the additional open-hearth capacity put into operation was only 900,000 tons, or less than 29 per cent of the 1913 total.

On the other hand, new blast furnace capacity going into blast last year was only 550,000 tons, against 1,000,000 tons in 1912, and it was easily the smallest increase shown in any year during the last decade. A blast furnace plant reaches fruition only in several years after work is started, while new open-hearth furnaces can be added quickly, so that steelmakers are thus enabled to increase their capacity within a much shorter period.

Adding the 3,120,000 tons increased open-hearth capacity completed in 1913 to the 1912 production of steel ingots and castings of all kinds, would give 34,370,000 tons. All steelmaking furnaces were not operating in 1912, so that with every factor carefully weighed it is evident that the steel producing capacity of the country can be conservatively estimated as being nearly 37,000,000 tons. By steel production it is, of course, understood that figures on the output of ingots and castings do not represent the exact tonnage of steel made, as a large amount goes back as scrap and figures are thus duplicated. The largest installation of open-hearth furnaces was made at the Edgar Thomson works of the Carnegie Steel Co., where fourteen new 75-ton furnaces were put into operation. Reckoned in tonnage, the second largest addition was at the new No. 2 plant of the Lackawanna Steel Co., where two 200-ton Talbot tilting furnaces were added. Other large installations were made by the Youngstown Sheet & Tube Co., Brier Hill Steel Co., Bethlehem Steel Co., Pittsburgh Crucible Steel Co., and the Inland Steel Co.

The production of open-hearth steel exceeded that of the Bessemer plants for the first time in 1908, but was

more than twice as much in 1912, after only a five-year interval. The reason why open-hearth steel production has made phenomenal progress, while that of Bessemer was maintained at the same level, is shown by the fact that against the 62 new open-hearths with a capacity of 3,120,000 tons, there was an increase of only two in the number of Bessemer converters. The Pennsylvania Steel Co., Steelton, Pa., added two 20-ton converters, which made steel in November, but this was properly not an increase, as the old Bessemer plant will not be operated under normal market conditions.

Furnaces Under Construction

The number of open-hearth furnaces under construction is 40, with a rated capacity of 1,830,000 tons, as shown in the accompanying table. While most of this increased capacity will be ready for operation this year, it is improbable that all will be finished during 1914.

The American Iron & Steel Mfg. Co., Lebanon, Pa., is installing two electric furnaces to operate in conjunction with its new open-hearth plant, now being built. It will be the largest single installation of electric furnaces in the world.

Following are the details of the increases in capacity or in plant facilities, made by a number of the leading iron and steel companies during 1913, or now being built:

Allegheny Steel Co., Brackenridge, Pa.—One new 75-ton basic open-hearth furnace was placed in operation on March 13.

Alton Steel Co., Alton, Ill.—A new plant for the manufacture of bands, hoops and cotton ties completed in November, 1913. Two 40-ton open-hearth furnaces, oil-burning, one basic and one acid, were built. The rolling mills include a 32-inch, two-high, steam-driven blooming mill, an 18-inch, three-high billet mill, a 12-inch Morgan continuous bar mill and 10 and 8-inch, two-high bar mills. All the mills except the blooming mill are electrically-driven. The new furnaces will produce about 75,000 tons annually, the rolling capacity being somewhat in excess of the company's steelmaking capacity.

Apollo Steel Co., Apollo, Pa.—New sheet mill began operating in June. Has six sets of finishing rolls, four sets of roughing rolls and two sets of cold rolls. The plant is electrically-operated throughout. Annual capacity about 30,000 tons of black, galvanized and corrugated sheets.

American Iron & Steel Mfg. Co., Lebanon, Pa.—This company has contracted for the largest single electric furnace installation for the refining of steel in the world. Contracts were closed in December with Siemens & Halske, Berlin, Germany, for the construction of two 20-ton Frick induction furnaces. These furnaces will be of double ring type and will be run on five cycles, single phase, with a current of about 5,000 volts. Their power requirements will be 1,800 kilowatts each. They will be completed the latter part of this year. The company will refine liquid steel taken from a group of four 50-ton open-hearth furnaces, contracts for which were placed with the American Bridge Co. in July. The refining capacity of the electric furnaces will be from 10 to 20 tons per heat, or from 200 to 400 tons per furnace daily, a total capacity of 400 to 800 tons per day. Steel produced by this process will be rolled on a billet mill now being built, and later finished into bars, nuts and bolts, spikes and other products.

American Sheet & Tin Plate Co., Vandergrift, Pa.—Two 40-ton open-hearth furnaces built at the Apollo works.

American Steel & Wire Co., Donora, Pa.—Completed one 65-ton open-hearth furnace. At Fairfield, Ala., company is completing rod mill, with a capacity of 200 tons per turn, wire mill and other finishing departments.

Ashland Steel Co., Ashland, Ky.—Remodeled its rod mill, increasing the capacity 25 per cent. New cranes installed for the better handling of material and new condensing engine placed in operation.

Best Mfg. Co., Pittsburgh.—Two new warehouse buildings, 64 x 96 feet and 100 x 170 feet, respectively, were built.

Bethlehem Steel Co., South Bethlehem, Pa.—At the Saucon plant, six 75-ton open-hearth furnaces, and a new Bessemer and mixing department, were completed. Two 20-ton converters were removed from the old Bessemer department to equip the new. A new 1,000-ton mixer, the largest unit of its type in the United States, was put in operation. At the Lehigh plant, six 50-ton open-hearth furnaces are under construction as well as a new merchant mill department, which will be equipped with a 35-inch reversing blooming mill; four-stand, 22-inch mill; 16 and 12-inch combination mill; 12 and 8-inch combination mill, and a 10-inch guide mill. All will be new except the 12 and 8-inch mills, which are to be removed from their present location. In their place, new buildings are being erected to accommodate new 12, 10 and 8-inch hand mills. The improvements are described elsewhere in this issue.

Brier Hill Steel Co., Youngstown, O.—Completed and will have in operation early in January seven new open-hearth steel furnaces, each of 75-ton capacity, or a total capacity of about 1,200 tons of steel daily; 44-inch blooming mill for producing all sizes of billets; one merchant mill and one continuous mill for making all weights of sheet bars. The Youngstown plant will include new machine shops, boiler house, coal crusher, gas producers, soaking pit and power house.

At the Thomas plant, Niles, O., the company completed a six-pot galvanizing works, having a capacity of 1,100 tons of galvanized sheets per week. The sheet mill consists of 11 stands of hot rolls and six stands of cold rolls. Sheet bars for this plant will ultimately be shipped from the new Youngstown works.

Carnegie Steel Co., Pittsburgh.—Fourteen 75-ton open-hearth furnaces were added to the Edgar Thomson plant, first making steel Aug. 16. Two 60-ton open-hearths built at Clairton works, beginning operations Jan. 7. Gas producer equipment at the Duquesne works for 14 furnaces, using natural gas, will be completed early this year. At the Edgar Thomson works, new blooming and rail mills are under construction. A 10-inch merchant bar mill, capacity 10,000 tons per month, being built at Duquesne works, while a new 8-inch hoop mill began operations at the McCutcheon plant on July 21. A 4,000-kilowatt, 6,600-volt, alternating current, live steam turbo-driven electric generator installed at Edgar Thomson works to increase power producing capacity. A 3,000-kilowatt, 6,600-volt, alternating current, exhaust steam turbo-driven electric generator put in operation at Homestead works to reinforce existing facilities. The improvements at the Edgar Thomson works are described elsewhere in this issue.

Corrigan, McKinney & Co., Cleveland.—Work was started on a new steel plant, comprising eight open-hearth furnaces with an annual capacity of 450,000 tons. The plant will be connected by a bridge across the Cuyahoga river, with the company's blast furnaces, from which hot metal will be secured. Space has been left for six additional furnaces, either open-hearth or Bessemer converters, and the company has under consideration the use of the duplexing process.

The Deforest Sheet & Tin Plate Co., Niles, O.—A 54-inch jobbing mill with electrically-controlled roughing mill, blue annealing furnace, leveling machine, cooling equipment, and other accessories for the jobbing mill, together with three additional sheet mills, were added to the rolling mill department. The company now operates ten sheet mills. A new cold roll train of five cold mills, electrically-driven, was installed. A combined continuous box annealing furnace and transfer, by which the sheets are charged into one end of the furnace in the rolling mill building and boxes delivered at the other end into the galvanizing department, was added. The main mill building was extended 160 feet, the galvanizing building 100 feet and a leanto 35 feet wide and 800 feet long erected along the entire length of the main mill building. A building, 60 feet wide and 540 feet long, was added to the finishing department, the addition being used as a loading shed and assembling room. New electrical equipment installed includes one 1,500-kilowatt Westinghouse mixed pressure turbine and electric generating unit, together with a motor generator set, a steel and concrete power house, electrically-driven pump and water lines necessary for the operation of this unit.

The Falk Co., Milwaukee, Wis.—A new 25-ton open-hearth furnace, together with six gas producers, completed in June. The furnace increases the company's steelmaking capacity by about 22,500 tons annually. Described in THE IRON TRADE REVIEW, June 26, 1913, page 1449.

Franklin Steel Works, Franklin, Pa.—Plant badly damaged by fire in June and work of rebuilding and enlarging has been started. Main building will be 75 x 700 feet and will house the 9-inch, 12-inch and 18-inch mills. The

small mill will be driven by a 500-horsepower motor, and others by steam power, rope drive. Two 10-ton electric traveling cranes will be installed. The machine shop, steel construction, will be 45 x 100 feet, commanded by a 5-ton crane. The roll shop will be 45 x 60 feet, served by a 5-ton crane. A blacksmith shop and boiler house will be built. The company expects to make steel by June 1. An 18-inch mill, which was not injured by the fire, continued in operation. The Chicago Railway Equipment Co. is owner of the works and the output is largely for railroad use.

Harrisburg Pipe & Pipe Bending Co., Harrisburg, Pa.—A three-high, 21-inch universal plate mill, of the company's own design, installed in rolling mill department, replacing a 20-inch groove mill.

Howe & Samuel, Danville, Pa.—Building a new puddling and rolling mill for producing high grade iron bars. Eight double puddling furnaces having an annual capacity of 6,000 tons are being erected. The mills of the old plant are being used in the one under construction. The old plant comprised seven double puddling furnaces.

Impervious Sheet Steel Co., Rochester, Pa.—Organized in 1912 and building plant.

Indiana Steel Co., Chicago.—A new 36-inch slabbing mill to be operated in connection with the universal plate mill nearing completion.

Inland Steel Co., Indiana Harbor, Ind.—Four new furnaces, each of 60 tons capacity, a 90-inch shear plate mill and a battery of 66 Koppers by-product coke ovens were added. The new furnaces increased the capacity of these works by 50 per cent, the increase amounting to about 210,000 tons a year. The coke ovens were fired the first week in August. These additions are described elsewhere in this issue.

Jones & Laughlin Steel Co., Pittsburgh.—Building 240 rectangular coke ovens, designed by company's engineers, but similar to the Belgian type, at Woodlawn, Pa.

La Belle Iron Work, Steubenville, O.—One 60-ton open-hearth furnace completed in July. Warehouse extended and additional cranes and crane runways provided. Company expended $250,000 during the year in improvements.

Lackawanna Steel Co., Buffalo.—Two 200-ton Talbot continuous open-hearth furnaces placed in operation in August at the No. 2 plant. When operated by the duplexing process, will have capacity of 20,000 tons each per month. Four stationary open-hearth furnaces are being built at the No. 2 plant, while four additional units are planned Each will be of 60 tons capacity.

Leetonia Steel Co., Leetonia, O.—Organized in 1913, and purchased the McKeefrey blast furnace of the Salem Iron Co. Work begun on plant planned ultimately to include two 70-ton open-hearth furnaces using hot metal direct from blast furnace; a 30-inch, three-high bar mill, rolling billets and sheet bars; ten hot and seven cold sheet mills.

Logan Iron & Steel Co., Burnham, Pa.—Alterations made to 18-inch finishing mill, which will add about 500 tons of bar products additional each month.

Lukens Iron & Steel Co., Coatesville, Pa.—Continued building of one 50-ton open-hearth furnace, which will be completed this spring and will increase ingot capacity about 20,000 tons per year.

Mark Mfg. Co., Evanston, Ill.—New plant for the manufacture of cold-drawn seamless steel unions completed in May. The main building is 75 x 200 feet, with a wing, 75 x 150 feet. Described in THE IRON TRADE REVIEW, June 5, 1913, page 1291.

Maryland Steel Co., Sparrows Point, Md.—Rebuilding blast furnace "A". Type of construction is a compromise between thin-lined and internally-cooled, thick-lined design. Furnace "C" being remodeled at close of year. Announced plans in May for 24-inch structural and bar mill, the present finishing capacity comprising only a rail mill. A small battery of six 15-ton Koppers by-product coke ovens charged first week in August. Construction started on second plant of two batteries, each containing 60 Koppers, cross-regenerative by-product ovens.

Minnesota Steel Co., Duluth, Minn.—Continued the building of its new blast furnace and steel plant. Present status of construction described in THE IRON TRADE REVIEW, Nov. 13, 1913, page 867.

George M. Newhall Engineering Co., Hyde Station, Pa.—Began operation of mill for rolling light steel rails weighing from 16 to 45 pounds per yard. The mill was built by the Clearfield Steel & Iron Co., several years ago.

Pennsylvania Steel Co., Steelton, Pa.—Announced plans May 15 for complete new duplexing unit for steelmaking, consisting of two continuous 75-ton open-hearth furnaces of the company's own design, two 20-ton Bessemer converters, hot metal mixer and new blowing equipment, together with one 75-ton stationary open-hearth furnace. Following the completion of the duplexing and stationary open-hearth capacity, the old Bessemer plant together with a number of the old open-hearth furnaces will be abandoned for normal operation. Except in emergencies, the alterations will make little change in the ingot capacity. The present merchant mill will be enlarged to enable it to roll a wider and larger assortment of shapes and sizes. The new Bessemer plant comprises two 20-ton converters and an 800-ton metal mixer, located in an extension of the open-hearth building, with which it has direct crane connection, and was started Nov. 28. It will make a specialty of manufacturing Mavari and chrome-nickel steel by the duplexing process. The company announced in November that the No. 2 Bessemer mill would be dismantled, No. 1 Bessemer mill, the first to make rail steel in Pennsylvania, having been dismantled some time previous.

Pittsburgh Crucible Steel Co., Midland, Pa.—Eight 60-ton open-hearth furnaces, six basic and two acid, completed and put in operation. They have a rated capacity of 60 tons each, a monthly capacity for the eight of 30,000 tons. Two basic open-hearth furnaces are being built. A 500-ton pig iron mixer and a 40-inch blooming mill also placed in operation. When completed, the plant will comprise 10 open-hearth furnaces, a 500-ton mixer, a pig casting machine, 40-inch blooming mill, 24-inch bar mill, 8, 10 and 12-inch merchant mills, plow plate mill and coulter shop.

Reliance Coke Co., Denbo, Pa.—Completed 236 rectangular coke ovens, 60 of which have been placed in operation. The balance will be charged as soon as the development of the mine permits.

Republic Iron & Steel Co., Youngstown.—Added two 65-ton open-hearth furnaces to the Lansingville plant, the furnaces making steel for the first time in September. At the Brown-Bonnell works, Youngstown, the new 8, 12 and 20-inch bar steel jobbing mills were started, the 8-inch in March, the 12-inch in April and the 20-inch in September. The company has under construction a by-product coke plant of the Koppers type, consisting of 68 ovens of an estimated capacity of 1,000 tons of coke per day. These ovens will be completed early this year.

John A. Roebling's Sons Co., Trenton, N. J.—Completed and put in service three additional open-hearth furnaces at Roebling, N. J. The furnaces have a capacity of 40 tons each, increasing the company's annual ingot capacity by 60,000 tons. Additional capacity was provided in the blooming mill, while increased heat-treating equipment was installed at both the Trenton and Roebling plants.

Schuylkill Haven Iron & Steel Co., Pottsville, Pa.—Announced plans for an extension 200 x 400 feet, containing seven additional puddling furnaces, a heating furnace and an 8-inch mill.

Standard Seamless Tube Co., Pittsburgh.—Purchased a site at Economy, Pa., on which a plant for manufacturing hot and cold-rolled seamless tubing will be built during 1914.

Trumbull Steel Co., Warren, O.—Completed new sheet and tin plate plant, manufacturing both flat and corrugated black and galvanized sheets, formed roofing products, metal ceilings, etc. In addition to bright coke and charcoal tins, terne or roofing tins, charcoal iron ternes, long terne sheets, fire door plate, etc., are manufactured. The rolling equipment consists of six sheet mills, six mills for rolling black plate for tinning and 13 stands of cold rolls, with a combined capacity of 60,000 tons per year.

Valley Mould & Iron Co., Sharpsville, Pa.—Is re-arranging and extending its ingot mold foundry to provide considerable additional capacity.

Weirton Steel Co., Weirton, W. Va.—Built plant for manufacturing cold-rolled and cold-drawn steel strips, a highly finished product. Owned by E. T. Weir and associates in the Phillips Sheet & Tin Plate Co.

West Penn Steel Co., Brackenridge, Pa.—Installed one heavy duty press for bundling sheet scrap, housed in a new steel building, 25 x 80 feet, served by a five-ton crane.

Wheeling Sheet & Tin Plate Co., Yorkville, O.—Began construction of tin plate plant last year and in December placed five hot mills in operation. Five additional mills will be operating early this year. When complete, the plant

will have 12 hot mills, with an annual capacity of approximately 1,000,000 boxes of tin plate. The plant is described elsewhere in this issue.

Wisconsin Steel Co., Chicago.—Placed contract in March with the United Engineering & Foundry Co., Pittsburgh, for a new bar mill to be used for handling agricultural shapes of special sections and having a capacity of 3,000 tons a month.

Alan Wood Iron & Steel Co., Ivy Rock, Pa.—Continued the installing of a new 84-inch plate mill for rolling light gages, which will have a capacity of 50,000 tons a year. The mill will be completed during the first quarter. A new soaking pit installed, making five soaking pits in all, with a capacity of about 1,000 tons daily.

Woodward Iron Co., Woodward, Ala.—A second battery of 80 13¼-ton Koppers by-product coke ovens was built. An initial battery of 60 ovens was built in 1910.

Youngstown Sheet & Tube Co., Youngstown, O.—This company became a producer of open-hearth steel last year, when six 100-ton open-hearth furnaces were put in service. The first heats were taken out of these furnaces on the following dates: Furnace No. 1, May 1; furnace No. 2, May 2; furnace No. 3, June 3; furnace No. 4, July 6; furnace No. 5, Aug. 10; furnace No. 6, Sept. 6. The furnaces have a capacity of about 360,000 tons a year. In conection with the open-hearth plant, 18 Hughes mechanical gas producers were installed. In Bessemer department, a Southwark-Rateau turbo-blower was put in operation. A 44-inch blowing mill also was installed.

Zug Iron & Steel Co., Pittsburgh.—Plans a complete new layout, including 12 additional puddling furnaces, new squeezer and muck mill. The company is also considering the reconstruction of its 8, 10 and 18-inch mills and the installation of a new universal mill.

Plants Dismantled During 1913

Belfont Iron Works Co., Ironton, O.—On July 16, directors ordered the dismantling of the company's cut nail factory, one of the oldest in the country, having been operated for 50 years.

Boonton Iron & Steel Co., Boonton, N. J.—Rolling mill plant is being dismantled. Part of the equipment was sold to the Rockaway Rolling Mills, Rockaway, L. I. The Boonton plant consisted of nine double puddling furnaces, four heating furnaces and three trains of rolls, the annual capacity being about 25,000 tons of bars. It was operated until a few months ago.

Douglasville Iron Co., Douglasville, Pa.—Old rolling mill plant purchased by Mayer Pollock, scrap dealer, Pottstown, Pa. Plant dismantled and equipment sold as scrap.

Empire Steel & Iron Co., Catasauqua, Pa.—Dismantling No. 3 blast furnace at Catasauqua, the blast furnace plant now comprising Nos. 1 and 2, the latter a new furnace. The company formerly had six furnaces at Catasauqua. Henry Clay furnaces at Reading were abandoned a year ago. The company now has five blast furnaces, Crane Nos. 1 and 2, Oxford, Topton and Macungie.

Franklin Iron Mfg. Co., Franklin Springs, N. Y.—Franklin blast furnace built in 1871 and remodeled in 1883, dismantled.

Marshall Iron Co., Newport, Del.—Plant purchased in August by Frank Samuel, Philadelphia. Machinery was sold and plant dismantled. These works were built in 1873 and operated until 1910. They were equipped with one double puddling furnace, one reverberatory heating furnace, three grate furnaces, four annealing furnaces, three 22-inch sheet mills and one 22-inch bar mill. Their capacity was 4,000 tons of iron sheets annually.

Tyrone Iron Co., Tyrone Forges, Pa.—Plant purchased by Michlovich & Co., Harrisburg, dealers in old material, and is being dismantled. This plant has been numbered among the historic charcoal bloomeries of the Juniata valley in eastern Pennsylvania. The forges were first established in 1809 and rebuilt in 1870. A rolling mill of two trains was added in 1883 and enlarged in 1898. The product of the works was sheared and grooved rolled iron and steel skelp, a specialty being made of knobbled charcoal iron boiler tube skelp.

Pig Iron Capacity and Requirements of Country

By B E V Luty

There has been another year of very little blast furnace construction, only four absolutely new blast furnaces being added to the list in 1913, two Pittsburgh Steel Co. furnaces at Monessen, Pa., one (D) of the Youngstown Sheet & Tube Co., and one furnace of the Oriskany Iron & Ore Corporation. These have a combined capacity of about 550,000 tons annually. Previous annual reviews in this series showed new furnaces of 1,000,000 tons capacity in 1912, and of 565,000 tons capacity in 1911, making an annual average in the past three years of 705,000 tons, whereas the average of new construction in the six years preceding, 1905 to 1910, inclusive, involved 1,567,000 tons annually.

The annual capacity of new blast furnaces completed in the years named has been as follows, in gross tons:

1905	1,292,000
1906	1,135,000
1907	2,065,000
1908	1,188,000
1909	1,930,000
1910	1,794,000
1911	565,000
1912	1,000,000
1913	550,000

With any grouping of years that may be selected, pig iron production in the United States doubled every ten years from the time of the earliest important production through the year 1906. Of course, if isolated years be taken at ten-year intervals, there would be "off" years sometimes included, and these would show a failure to double, but this would be made up in the next period. Taking the collective production of each period of ten consecutive years, a more or less regular doubling has always been shown. A group of ten years including the great industrial depression of the nineties would show a failure to double, over the preceding ten years, but the following ten years would show an increase correspondingly greater than a mere doubling; there would at any rate be a quadrupling in 20 years.

Ratio Not Maintained

On the other hand, any comparison that is made to include recent years, since 1907, will fail to show a doubling. The past year's production of 31,000,000 tons, although easily breaking all previous records, shows an increase over 1903 of only 72 per cent, while the five years ending in 1913, combined, show an increase over the five years ending 1903 of only 75 per cent.

For several years, the prediction has been made that the rule would break down. Now it is no longer a theory; the rule has actually broken down. The lost ground could not be recovered in the next few years; there would have to be a phenomenal burst of demand, and there would have to be new construction at an impossible rate, for the production of 1913 was but little under the actual capacity.

It should have been obvious from the start that the rule would break down. It represented a geometrical progression, whereas there are few things in human activities that proceed for any length of time in such manner. Population has been increasing at only slightly more than 20 per cent per decade, which is very far from 100 per cent. It is true the activity of the people, as to construction and consumption, increases per capita, so that the sum total of activity increases more rapidly than the population increases, but still the sum total

does not increase by 100 per cent per decade. One measure of the total activity is the ton-miles of freight moved. Until lately this doubled every 12 years, but recently there has been a decline in the rate of increase. The rapid increase in the consumption of iron was due to its filling an important place in industrial activity; its availability created wants, while also it has been supplanting other materials. Since the development was altogether a new one, no one could foresee how far it would go before the rate of increase would decline.

Another factor which was certain eventually to disturb the rule of geometric increase was that much of the iron produced was not consumed, but was put into use. This affected the case in two ways: First, a need created would involve the use of much material, say in a given year, but in succeeding years the facility would merely be used, not requiring replacement; second, when material had passed through a life, it would frequently return as old material, to be reworked, and thus to displace pig iron.

The "Store of Iron"

As long as the rule was followed that in each period of ten consecutive years the total production was, on the average, double that of the preceding 10 years, this fact obtained, that approximately one-half of all the iron in existence had been made within ten years, and was thus less than five years old, while three-fourths had been made within 20 years and had an average age of only about seven years. Nearly all the iron which had been made up to date was in existence, and nearly all that was in existence was performing a useful function. Thus the store of iron rapidly increased.

In recent years, in the past half dozen years, two important changes in trends have occurred, which separately promise interesting results. In the first place, the rate of increase in production has declined, and this has the effect of making the total store of iron of a greater average age. Less than half of the total made to date has been made in the past ten years. Year by year, this fact will be felt more and more, whereby the decrease in the rate of increase ought to be less and less as time passes, other things being equal. In the second place, there has been a change in the average distribution of the tonnage. A smaller percentage of the total output goes into permanent use, and a larger percentage goes into temporary use, from which there is little recovery of old material. The production of sheets and tin plates, for instance, has increased much more in the past few years than has the total production of steel, and as to much of this material a fresh lot is actually consumed each year. No matter what the store of iron may be, such complete consumption is destined to increase year by year.

Thus the new trends which have established themselves in the past few years make it that while production used to increase by 100 per cent in 10 years, now it is increasing by say 70 per cent in ten years, but it does not follow that if the rate decreases from 100 per cent to 70 per cent, it will then decrease to 70 per cent of 70 per cent, or 49 per cent, and then to 70 per cent of 49 per cent, or 34 per cent, and so on. There will be a time when the rate of increase will no longer decrease.

The Use of Scrap

It is only in recent years that the consumption of old material in steel making has been important. When the basic open-hearth furnace had its early vogue, the average charge was approximately one-half scrap and one-half pig iron, but this did not mean, as was inferred by many at the time, that the scrap was old material. There was no occasion to use much old material, nor was there a great deal available. For example, assume that on the average 20 per cent of the steel ingot goes into new scrap, including scrap produced by final fabricators, such as car shops, structural iron shops, boiler shops, machine shops, etc. Assume that the total production of steel ingots is 10,000,000 tons, then the new scrap produced will be 2,000,000 tons, which will furnish one-half the charge required in making 4,000,000 tons of open-hearth ingots. In other words, if the production of open-hearth steel is two-thirds that of Bessemer steel, there will be enough new scrap produced. Through the year 1902 the proportion was less than two-thirds; in 1903, it was a shade over two-thirds, and in each succeeding year the proportion has increased, 1908 being the first year in which open-hearth steel exceeded Bessemer.

The proportion of scrap used in open-hearth steel making, however, has decreased, so many plants using processes—the duplex, for instance—which reduce the need of scrap. Thus, until quite lately, the consumption of old material has not been relatively heavy. Indeed, it could not be, for the material does not come back very quickly. Of course, every variety of employment is a case by itself, but suppose that all scrap did obey the rule of coming back in 20 years, then if production doubled every ten years, the current outcome would be in relation to the output of 20 years earlier, and that would have been only one-fourth of the current production, while the outcome, through losses, would be still less. The outcome of scrap increases as the rate of production was increasing at the time when the material was being put into use. Hence, any decrease in the rate of increase in new production means that the outcome of old material will become a larger percentage of the current production. That is occurring at the present time; the market is feeling the effects of the rapid increase in steel production 10 years, 15 years and 20 years ago, while it is not increasing its requirements in the same ratio. To an extent, therefore, the increased outcome of scrap is operating to decrease the need for building new blast furnaces, even though the production of steel increases. In view of the increased diversion of steel into light lines, whence it cannot be recovered, the trend is not really a strong one.

Present Blast Furnace Capacity

The theoretical blast furnace capacity of the country means nothing. Summaries have sometimes been made by adding up the rated capacities of all furnaces in existence. Usually in such cases there is not the requisite allowance for time lost through accidents and ordinary repairs, including relinings, yet in the aggregate these are unavoidable. Furthermore, there is a constant flux, whereby a furnace becomes incapacitated, through being in a district which loses its advantage of position, through not being kept up physically, through the owner losing his hold upon the market, and through other influences. Finally, the costs of production vary quite widely so that at best there is merely one total capacity for the country at one set of market prices, and another at another set. The clearest conception of the real commercial capacity is obtained by picking out a given time when the furnaces are fairly active, observing the actual rate of production, and then estimating what percentage of the idle capacity could become productive under those conditions, or under conditions more favorable by a stated amount than the existing conditions. Early in 1913 the rate of production rose to 34,000,000 tons. Pig iron is now an average of $3 a ton

cheaper than then, and the capacity which can profitably produce at present prices is much less than 34,000,000 tons. To estimate what will be our actual commercial capacity in 1914 requires, therefore, that one prophesy what will be the market price of pig iron, or at least the price relative to the cost of raw materials to such furnaces as must buy them. Allowing for the new construction of the past year, it is safe to assert that our capacity for producing pig iron, with prices no more than $2 a ton above the present level, is not over 35,000,000 tons annually at the outside. The capacity at the close of 1907, six years ago, was 28,000,000 tons, so that in six years there has been an increase of only 25 per cent. New construction and improvements have added much more than this amount, but on the other hand changes have occurred, by way of lowering selling prices. Inasmuch as the industry has adjusted itself to these changes, nobody expecting to sell pig iron at $20 to $25 a ton as was done in 1907, it is proper from a practical standpoint, the standpoint of one who is wondering whether the rank and file of the industry is promised employment, to take it that in six years the blast furnace capacity expecting employment has increased only about 25 per cent.

Open-Hearth Construction

There has been no continuous trend in the relation of blast furnace construction to open-hearth steel construction. A few years ago, the interests which had open-hearth steel plants were building blast furnaces more than they were increasing their steel capacity. That was the general rule. In the past two years, there has been somewhat of a change. Several merchant furnaces have been paired off with steel making, either through existing steel works buying furnaces, as with two steel interests in the east, or through merchant furnaces having steel works added to them, as with Midland and Brier Hill. Again, some of the older steel works have increased steel making capacity without increasing blast furnace capacity. The inference in such cases is that more old material will be used than formerly. It has been the common viewpoint that while blast furnace construction has been very slack in the past three years, the building of steel capacity has been rather active. The difference, however, has not been great. The increase in steel making capacity is also small, in percentage of existing capacity, as compared with the rate of construction which used to prevail.

GENEROUS TREATMENT

Of Employes Urged by Judge Gary in Addressing Presidents.

In a recent address to the presidents of the subsidiary companies of the United States Steel Corporation, Judge E. H. Gary reviewed conditions at length. He said that future conditions depend to some extent upon the intention of those who are in authority at the seat of government. He expressed the belief that underlying conditions are sound and that there is no ground for fear in regard to the finances of the country. Suggestions of financial distress are, he said, calculated to make the banks and the money interests more diligent in protecting themselves against disaster.

Judge Gary referred to recent national legislation and compared the action taken by congress to an operation performed upon the body. Regardless of the wisdom of the different measures, it would be foolish, he said, to overlook the fact that there must necessarily be some strain upon conditions by reason of these important and perhaps somewhat radical changes of the laws of the country. He therefore urged prudence in expenditures. "Great care should be exercised to conserve your resources. With the strongest hope that business will increase in the future and that as a result profits will increase and finances improve, we should nevertheless be prepared for a longer depression in business than we now expect. This Corporation and its subsidiaries should never run the risk of being short of cash resources. It would not be saying too much to suggest that if this Corporation should find it necessary to borrow large sums of money on short time notes, as some railroads have done, it would have not only a bad effect upon the credits of the country, but might have a decided influence in bringing about a financial panic."

While urging economy, he said that necessary expenditures should be made. "Foremost under that head," said Judge Gary, "I would say any money you can pay out to increase the safety of your employes is necessary and proper. Never hesitate to request appropriations for expenditure of money which is calculated to prevent accidents to your employes. Keep that thought uppermost in your minds and remember that any such requests will be promptly approved."

Judge Gary complimented the presidents of the subsidiary companies for the effort they had made to secure the good will of their employes. Nothing like it, he said, was ever heard of before in this country or any other country. He believed the employes would be grateful. He urged the presidents to investigate as to whether there is distress among former employes who are out of work. "I trust the presidents themselves will take occasion," said Judge Gary, "to visit the places where these families live, to ascertain how they are getting along and, if necessary to prevent suffering on their part, that you will be willing to contribute for the relief of these people. Some of these families are occupying your houses, and while out of work they may be unable to pay rent. In such cases, leave the families in the houses; suspend the rent until they are able to pay it."

Judge Gary urged that men be kept at work as much as possible, and suggested that some might be employed in cleaning up and putting properties in condition.

Sale of an Historic Mine

The sale of the Andover Iron Mine in Sussex county, New Jersey, to the American Steel & Wire Co., has been recently concluded. The recorded price is nominal, but it is reported that about $100,000 was paid for the property. This is one of the historical iron mines of New Jersey. It was worked before the Revolution, and it is recorded that the mine and furnaces at Andover were taken possession of by the Continental congress and were worked to supply the army with iron and steel. It was abandoned after the Revolution until 1847, when the Trenton Iron Co. operated it until 1863, producing about 120,000 tons. The total output is estimated at 400,000 tons. The ore is both magnetite and hematite. The workings were mostly open pit. The one pit is 30 to 60 feet wide and 850 feet long. Underground work to a depth of 200 feet disclosed the ore body for more than 1,200 feet in length in all. The Sulphur Hill deposit, the northerly extension of the Andover ore body, is entirely magnetite and was worked to a depth of 175 feet. This produced as late as 1880. These mines have associated with the iron some manganese and a small amount of zinc. No announcement of the plans of the new owners of these properties has been made.

The Lufkin Foundry & Machine Co., Lufkin, Texas, has decreased its capital stock from $200,000 to $149,500.

FEW CONTRACTS

For New Buildings—Allegheny Station is Awarded.

New York, Dec. 30. (By wire.)—The holiday spirit continues to dominate the structural market. Lettings are few. The most important is the Pennsylvania railroad freight station and office building, Allegheny, 1,500 tons, which, it is reported, has gone to McClintic-Marshall Co. An apartment in New York, 560 tons, went to the Belmont Iron Works. Bids are in on 1,000 tons for the Delaware & Hudson building, Albany.

Fabricating contracts reported in the west last week total 3,458 tons, including 2,158 tons of railroad business. A reinforced concrete Y. M. C. A. building at Grand Rapids, Mich., will require 600 tons of steel and the New Minnesota Club, at St. Paul, another reinforced concrete structure, will contain 300 tons. The exact figures on the Crane Co.'s contract reported last week are 2,254 tons. This was let jointly to the South Halsted Street Iron Works and the Vierling Steel Co.

Kansas City Terminal Railway Co. has awarded bridge steel for various crossings, 2,000 tons, to the American Bridge Co.

A power plant addition for H. J. Heinz Co., Pittsburgh, 800 tons, was awarded to the Jones & Laughlin Steel Co.

The contract for furnishing structural steel for new coaling station at Pearl Harbor, Hawaii, has been awarded to United States Steel Products Co., New York, for $156,785.

INCREASED BUSINESS

In Spite of Slump in Last Half in Cincinnati Machinery.

The Cincinnati machinery market shows an improvement of 8 per cent in business done in 1913 over that of 1912. This is somewhat surprising, as the past year was not generally considered a very good one. Transactions during the first six months, however, were fairly good, and partly counterbalanced the extreme dull period experienced during the last six months of the year. Business, as a general rule, was rather spotty, and was not always evenly distributed among the manufacturers, with the result that some were usually busy, while others were never running at full capacities of their respective shops. At the beginning of the year the majority of the shops were fairly busy, and there was a decided scarcity of help. As a result, a few of the machine tool makers were unable at that time to run night shifts, although it was apparently necessary for them to do so. At the end of the year, however, not more than three or four machine tool manufacturers in that city were running 60 per cent or over of their full capacities, and others were barely operating. Machinists were also being laid off each week because of the lack of orders. A fairly good export business was experienced about June or July, and, taken as a whole, export and domestic business done during the year was about equal. The tariff revision bill passed by Congress in October had a decided effect upon the machine tool business in that a number of prospective buyers postponed closing their contracts until its direct effect could be better determined. At the close of the year there were several large lists pending, principally from various railroads, and if they should be contracted for soon after the first of 1914, a decided improvement in the machinery market should result.

RAILROAD BUYING

Is Very Light—Grand Trunk Orders Stock Cars.

Car builders and manufacturers of railroad equipment viewed the passing of 1913 with no regrets, the past six months having furnished extremely little business. There is a slightly better tone in the railway supply field at present, although no extensive improvement in business is expected until the pending freight rate case is settled.

CAR AND LOCOMOTIVE ORDERS.

The Grand Trunk has ordered 500 stock cars with steel underframes and 10 steel frame baggage cars from the National Steel Car Co.

The Pacific Great Eastern of Vancouver, B. C., has ordered 44 steel frame box cars and 67 steel underframe flat cars from the National Steel Car Co.

The American Locomotive Co. has taken four compound consolidation locomotives for the American Railroad of Porto Rico.

The Canadian Locomotive Co., of Kingston has received the following orders: One saddle-tank locomotive for the British Columbia Equipment Co., Vancouver; two saddle-tank locomotives for the Confederation Construction Co., Welland Canal, one saddle-tank locomotive for the Union Carbide Co., Welland, and six moguls for J. D. McArthur, Hudson's Bay Construction Co.

The Nova Scotia Car Works, Halifax, has received a large order for cars for the Inter-Colonial Railway, sufficient to keep the plant in operation for about three months.

PIG IRON PRICES

PITTSBURGH

(Through First Half 1914.)

Bessemer	$15.15
Basic	13.50 to 13.65
No. 2 foundry	13.90 to 14.15
Malleable	13.90 to 14.15
Gray forge	13.90

(The freight from valley points is 90c.)

CLEVELAND

(Through First Half 1914, Delivered in City.)

No. 1 foundry	$14.00
No. 2 foundry	13.50
No. 2 southern	15.10 to 15.35
Bessemer	15.15
Silveries, 8 per cent silicon	18.55

CINCINNATI

(Prompt and First Half.)

Southern foundry No. 1	$14.25 to 14.75
Southern foundry No. 2	13.75 to 14.25
Southern foundry No. 3	13.25 to 13.75
Southern foundry No. 4	13.00 to 13.50
Southern gray forge	12.75 to 13.25
Mottled	12.75 to 13.00
Southern No. 1 soft	14.50 to 15.00
Southern No. 2 soft	14.00 to 14.50
Southern Ohio No. 2	14.20 to 14.70
Southern Ohio No. 3	13.70 to 14.20
Southern Ohio No. 4	13.45 to 13.95
Silveries, 8 per cent silicon	17.70 to 18.20

(Freight from Ironton, $1.20; from Birmingham, $3.25.)

CHICAGO

(Delivered Chicago, until July 1, 1914, except northern foundry and malleable Bessemer, which are quoted f. o. b. local furnace.)

Lake Superior char., No. 1 to 4	$15.50
Northern foundry No. 2	14.25
Southern foundry No. 2	15.35
Jackson Co. silveries, 8 per cent	19.40
South'n silveries, 5 per cent sil.	16.85
Alabama basic	15.35
Malleable	14.25

PHILADELPHIA

(Prompt and first half shipment delivered to consumer's plants in Philadelphia and vicinity, unless otherwise specified.)

Northern No. 1X foundry	$15.25 to 15.50
Northern No. 2X foundry	14.75 to 15.25
Northern No. 2 plain	14.50 to 14.75
Standard forge (Eastern Pa.)	14.50 to 14.75
Virginia No. 2	15.55 to 15.80
Southern No. 2	15.00 to 15.50
Standard low phos., Phila	20.75 to 21.50
Lebanon low phos., furnace	17.50 to 18.00
Malleable	15.00 to 15.50
Basic (Eastern and Central Pa.)	14.25
Middlesbrough, English No. 3 (on dock)	14.25 to 14.50

NEW YORK

(Prompt and first half delivery, prices based at Jersey City and at Jersey points near tidewater.)

Northern No. 1X foundry	$14.75 to 15.00
Northern No. 2X foundry	14.50 to 14.75
Northern No. 2 plain	14.25 to 14.50
Virginia No. 2X	15.80
Southern No. 2	14.75 to 15.25
Malleable	14.50 to 15.00
Gray forge	14.25 to 14.50

BIRMINGHAM

(For Southern Delivery.)

No. 1 foundry	$11.50 to 12.00
No. 2 foundry	11.00 to 11.50
No. 3 foundry	10.75 to 11.00
No. 4 foundry	10.50 to 10.75
Gray forge	10.50 to 10.75
Mottled	10.25
Standard basic	11.00 to 11.50
Off basic	10.50 to 11.00
Charcoal	25.00

ST. LOUIS

(Throughout This Year.)

Southern No. 1	$15.25 to 15.75
Southern No. 2	14.75 to 15.25
Southern No. 3	14.25 to 14.75
Southern No. 4	13.75 to 14.25

(Freight, Birmingham to St. Louis, $3.75.)

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Honesty in Contracting

More honesty is what the iron trade needs in the New Year. If every buyer will make a resolution today to be true to his written agreements and then live up to that resolution, a great change for the better will result. If every consumer will take every ton of material that he has agreed to take this year, even if it drives him into bankruptcy, he may be poorer in material possessions, but far richer in self-respect. The iron trade will be greatly strengthened and more entitled to the respect of the business world. One custom that is reprehensible weakens an entire system. One indefensible practice taints the whole trade. It is high time to cut it out.

The buyer is not, however, entirely to blame. Many a seller has not only tolerated, but encouraged the making of contracts which ought never to have been made and then has assisted in breaking them. He is weak in refusing to insist upon the enforcement of contracts. A New Year opportunity is presented to him as well as to the buyer. Sellers have made some progress in recent years, and particularly in 1913, in preventing the repudiation of contracts, and the year which has just passed into history has a cleaner record than many of its predecessors, but there still remains much to be accomplished.

One day, some weeks ago, in the Steel Corporation dissolution hearings, Judge Dickinson fairly gasped when a witness unblushingly testified that contracts were wantonly broken. No wonder that he was surprised. Everyone is when he first hears of the little regard shown for the written word by many in the trade. Even men whose oral promise would be good for thousands of dollars do not hesitate to repudiate the written contract.

May 1914 bring a keener appreciation of the sacredness of every contract and courage strong enough to enable every man to do his part in enforcing the contract.

The Year and the Outlook

The past few years in the history of the iron trade have been so remarkable that it is difficult to find an adjective which has not been over-worked to describe the past twelvemonth, and it is not surprising that one learned editor has called upon the Latin language for words to give an adequate idea of 1913. The year 1912 was remarkable for the recovery of the industry from a sadly demoralized condition to one of great activity. It was indeed a record-breaking year in many respects. The past year, however, has again broken records, and while 1912 made a record for the shipment of ore from the Lake Superior region, the past year, with its nearly 50,000,000 tons included in the movement, records even a greater achievement. Likewise in the production of pig iron, steel and finished products indications clearly point to new records.

In prices, the sharp advance of 1912 is strikingly

contrasted with the decline of the last half of 1913. The details of the changes in quotations will be found fully recorded in the annual market reviews published elsewhere in this issue. With the decline in prices, however, there was not the usual repudiation of contracts, and the demoralization which has characterized some periods of depression in the past was lacking. For the most part, buyers took the tonnages which they had agreed to take and gradually worked them out until now it is generally conceded that stocks on hand are very low.

A highly important event of the year was the enactment of the new tariff law, making a radical reduction in the tariff on iron and steel products, as well as putting some on the free list. Naturally this complete change of policy has aroused considerable anxiety, which has had a depressing effect upon business; but, as is shown by our New York representative in his annual review, there is not yet any positive evidence that the new law will be disastrous to the iron trade and letters published elsewhere in this issue show that manufacturers of iron and steel products and machinery are bravely meeting the new problems which are presented. No writhing in anxiety and torment is more terrible than that which is self-inflicted, but the pessimists will find that although in some respects they may be like the ascetics of India in self-castigation, and are making beds of thorns for themselves, or hanging themselves by their heels, other more cheerful folks are not writhing at all, but are standing hopefully with heads erect.

As the New Year dawns, there is a vast amount of optimism and an increasing confidence that before the year is far advanced, a comfortable amount of business will develop and that, on the whole, 1914 will give a good account of itself.

The Trend of Prices for 19 Years

A bird's eye view of market quotations for the past 19 years is furnished by the two charts which are printed on one sheet as a supplement to this issue. The figures on which the charts are based are the prices published in the market reports of THE IRON TRADE REVIEW. They are computed for the following: Tank plates, Chicago; beams, Pittsburgh; bar iron, Cleveland; Bessemer billets, Pittsburgh; Bessemer pig iron, Pittsburgh; No. 2 foundry, Chicago; southern gray forge, Cincinnati; No. 2 foundry, Birmingham; steel bars, Pittsburgh.

In the charts for 1911, 1912 and 1913, the vertical lines represent weeks, while in the charts covering 16 years the vertical lines represent months. In the two charts, the horizontal lines show prices in dollars per net ton in the case of finished materials and per gross ton in the case of pig iron and steel billets. The solid and broken lines traversing the diagram indicate changes in the prices at which a very large percentage of the tonnage was placed, but do not show the highest or lowest prices at which some tonnages may have been placed. For example, in the case of steel bars, the chart shows a quotation of 1.40c, Pittsburgh, or $28 per ton from Oct. 16, 1912, to Nov. 5, 1913. Doubtless some large buyers were able to buy below that figure, and in some cases premiums above that quotation were paid for prompt delivery. But nevertheless the ruling price on which all ordinary business was done was $28. This policy has been long followed and repeatedly explained in the columns of THE IRON TRADE REVIEW, because we believe that a permanent record of this kind should show the prices at which the great bulk of the business is taken and not extraordinarily high or low prices. In the case of pig iron, the minimum quotations for prompt delivery are used.

The lower chart shows the very short-lived boom in 1895, which followed the period of depression; then the decline in the latter part of 1895, followed by the slow general decline of 1896 and 1897, when in midsummer the lowest prices on record prevailed; the rather steady trend of prices from the middle of 1897 to the fall of 1898; the rapid rise at the close of 1898, followed by the very high quotations of the boom year, 1899; the sharp decline beginning in September, 1899, and continuing until the mid-summer of 1900; a partial recovery at the close of 1900, and the continuance of prices upward during 1901; the rapid advance during the first half of 1902 and sharp decline beginning in the fall of 1902 and continuing during 1903, followed by a long period of prosperity, with occasional recessions, ending suddenly in October, 1907.

Owing to the co-operative policy which prevailed throughout the year 1908, prices were much more regular than they would have been without it, but with the declaration of the open market early in 1909, the chart shows a dip in the lines, and then a gradual recovery beginning the middle of the year. But the high prices attained in other years of prosperity were not reached in 1909. The improvement was temporary and the year closed with prices on a number of products about the same as they were at the beginning of the year. The next downward trend started in February, 1910, and continued through that year and up to nearly the close of 1911, when the decline in prices was checked and some advances were made.

The chart showing prices for the past three years indicates the downward trend which started in June, 1911, the trend upward in 1912, the continuation of prosperity during the first half of 1913 and the sharp decline in the last half of the year. This decline is shown to be much more in the case of finished materials than in pig iron during the past four months, as the recession in pig iron was more decided earlier in the year. The decline in southern pig iron has been fully $4 per ton, and although $11 is given as the general quotation and is so carried in the chart, a gradually increasing tonnage is being taken at less than that figure.

In spite of the reduction in prices this year and in 1912, the general tendency of prices in recent years not to fluctuate as violently as they did in earlier years is still maintained. In the year of depression, 1911, the lowest prices of preceding years were not touched, nor were they this year; and in the year of prosperity, 1912, the highest points marked by boom periods were not reached. Owing to increased costs, the low points are not touched in periods of depression. In pig iron, for example, it is not at all likely that we shall ever see the low prices which prevailed at times in the last century.

IRON AND STEEL MARKETS

Optimism Prevails as the New Year Opens

And Repetition of the Prosperous Times of 1912 is Expected
—Very Low Quotations on Pig Iron in the Pittsburgh District

BY GEORGE SMART

Cheerful sentiment prevails at the beginning of the New Year, just as it did at the opening of the year 1912, after the depression and low prices during the latter part of 1911. In 1912, the expectations of the optimistic were realized and before many months had passed, a very large volume of business had been placed. This year, with fundamental conditions sound, there is fully as much reason for expecting a prosperous year as there was in January, 1912. The outlook is that mills will follow a very conservative policy in making contracts and will endeavor to discourage speculative buying.

The heavy operations of the first six months of the year made 1913 the largest year in output in the history of the iron and steel industry of the United States. The total production of steel ingots in 1913 is reliably estimated at about 32,500,000 tons, compared with 31,251,303 tons in 1912, and of finished rolled iron and steel products about 25,000,000 tons, compared with 24,656,841 tons in 1912. Pig iron production will be nearly 31,000,000 tons, exceeding the high record rate of the country of 29,726,937 tons, which was established in 1912. The United States Steel Corporation in 1913 produced about 16,500,000 tons of ingots, 12,000,000 tons of finished steel products and 13,900,000 tons of pig iron. In 1912, its output was 14,186,164 tons of pig iron, 16,901,223 tons of steel ingots and 11,964,792 tons of finished steel products. Hence the Steel Corporation's percentage of the total production of the country was somewhat less than in 1912. The floods in March caused considerable loss of production in iron and steel through the banking of many furnaces and the disabling of mills.

Pig Iron

Still further weakness has developed during the past few days in pig iron in the Pittsburgh district, where the sales of 500 tons of prompt basic at $12.50, valley, and 2,500 tons of January Bessemer at $14.25, valley, are reported and foundry iron is selling as low as $13. In 1912, the average cost of a well appointed valley furnace paying market prices for its ore and coke was slightly above $13 for foundry grades, and in that year old range non-Bessemer ores were sold at $3, compared with the present price of $3.60, while Mesabi non-Bessemer sold at $2.85, as compared with $3.40 the past year. Furnaces will be working for months on 1913 ore, but have already fully discounted the reduction in cost which would result from the granting of 1912 ore prices for the year 1914. It is by no means assured that the low ore prices of 1912 will prevail this year, and furnaces are finding it difficult to shade $2 on coke. There are, of course, a few companies having their own ore, which can sell pig iron at very low prices, but it seems certain that by the companies which are compelled to buy their ore, bottom prices are now being made and it is very probable that some furnaces are selling at below cost. A large electric and manufacturing company sounded the market on 15,000 to 20,000 tons for first half delivery, but has withdrawn temporarily. Inquiry in the Chicago district amounts to about 22,000 tons. Improvement is reported in the demand for pig iron in eastern territory.

Finished Materials

The increased interest of buyers noted during the past two weeks is being maintained and they are frequently more anxious to contract than are the mills, which are following the policy of asking $1 advance for delivery after the first quarter. Leading companies report that there are good prospects of large tonnages in shapes and bars being placed. An aggregate of about 175,000 tons of rails is about to be distributed by two eastern railroads among several mills and other roads are negotiating for 300,000 tons of rails. Structural lettings are moderate. The Union Pacific is negotiating for 5,000 cars and other western roads are in the market for 11,000 cars. Railroad buying, however, is light. Some very low quotations are being made on rivets. The wire market, although quiet, shows a tendency to firmness. Extremely low prices continue to be made on sheets.

Coke

Considerable more activity has developed in coke. About 100,000 tons have been sold to southern Ohio furnaces. Some of the heaviest consumers are covering at Pittsburgh, where at least 80,000 tons per month have been sold for shipment in the first half of the year.

Pig Iron Weaker in Pittsburgh Market

Bessemer Sells at $14.25, Valley, and Basic is Also Low —Specifications of Finished Materials Are More Liberal

BY C. F. WILLIAMS

Office of THE IRON TRADE REVIEW,
2148-49 Oliver Bldg.,
Pittsburgh, Dec. 31.

The end of the year finds most branches of the iron and steel trade decidedly dull and mills will not enter the New Year under the auspicious conditions that prevailed 12 months ago. Practically all the mills in this district were shut down a part of last week, but must of them have resumed operations. Inquiries for first half shipment are coming out in good volume and specifications against contracts have been more liberal this month than last.

Pig Iron

The market has displayed further weakness. The Pittsburgh Steel Foundry Co. has obtained 500 tons of prompt basic at what is reported to be $12.50, valley, but dealers are refusing to shade $12.75 for 1914 delivery. The Standard Sanitary Mfg. Co. has closed for a small tonnage of northern foundry at less than $13, valley, but will buy more iron this week. The sale of 2,500 tons of January Bessemer at $14.25, valley, or 75 cents below the nominal price, is noted. The Alice furnace of the Valley Mould & Iron Co., operating on basic, has been blown out; the Tod furnace of the Brier Hill Steel Co. is out and it is understood that the Andrews. & Hitchcock Iron Co. will blow out a stack shortly.

Ferro-Alloys

The Carnegie Steel Co., now figuring as a seller of ferro-manganese, denies that it is shading the prevailing price, $47, seaboard, for foreign grades. The price of 50 per cent ferro-silicon for 1914 is $73, Pittsburgh, for small lots, or $1 a ton less than the quotation for 1913.

Plates and Shapes

Inquiries are coming out more freely. Leading makers are holding plates and shapes at 1.20c for first quarter, although some mills are quoting 1.25c. Less talk of plates selling at 1.15c is heard.

Billets and Sheet Bars

The demand for first half shipment is heavier. Billets are being held at $20 and sheet bars at $21, mill.

Sheets

Specifications last week were above normal, despite the holidays, but prices have shown no improvement. Mills are not selling beyond Feb. 15, except when necessary.

Tin Plate

Specifying has been fairly liberal and some makers predict that tonnages shipped in 1914 will exceed those of last year.

Rails and Track Material

Inquiries continue to come out for rails, but actual buying has not been heavy. Negotiations for track equipment have been opened, but prices appear weaker.

Wire

The market is quiet. Reports are heard of material being sold $1 a ton less than the market. The market for wire rods is unchanged.

Iron and Steel Bars

Inquiries for steel bars amount to a fairly heavy tonnage for first half and mills are quoting 1.20c to 1.25c. Iron bars are quiet and somewhat weaker.

Tubular Goods

Pipe mills continue to enjoy activity. No large inquiries are pending, but numerous small orders continue to be placed.

Coke

Heaviest consumers are covering for 1914 and at least 80,000 tons a month have been sold for shipment in the first half of the year at less than $2, ovens, which leads some operators to believe that all the low-priced fuel has been taken off the market. The Youngstown Sheet & Tube Co. is understood to have closed for 45,000 or 60,000 tons a month for first half, but the exact price is not known. Another Ohio consumer has taken 10,000 tons for January at $2, ovens. *The Connellsville Courier*, for the week ending Dec. 20, says production was 284,964 tons, a decrease of 22,806 tons, compared with the week before.

Old Material

The Pennsylvania railroad is offering material, bids on which will close next week. Quotations are unchanged.

Clements Reappointed.—President Wilson has reappointed Judson C. Clements a member of the Interstate Commerce Commission. Successors to Judge Charles A. Prouty and the late John C. Marble will have to be appointed soon. Judge Prouty is still serving as commissioner pending the acceptance by the president of his resignation. Judge Prouty resigned that he might take up work in connection with the physical valuation of railroads.

MORE HOPEFUL

Is Feeling in the St. Louis District—Some Inquiry Pending.

BY E. C. ERWIN

Office of THE IRON TRADE REVIEW,
St. Louis, Dec. 30.

Sales of pig iron last week, and inquiries out today in the St. Louis market, lead local agents to believe that better times are not far away. An Iowa concern is asking for 1,000 tons of Southern No. 2X and No. 3 iron for first half delivery, and another concern for 200 tons of ferro-manganese, for first quarter. One melter asks for 600 tons of No. 3 southern for delivery over the next five months. Sales last week include 1,000 tons of malleable for first half delivery; 1,000 tons of No. 2 and No. 3 southern for delivery in Belleville, Ill., over the first half of next year, and 500 tons of billets for shipment to Kansas City, Mo. It is believed by the local agent who sold the billets that a like amount will be sold in Kansas City every month. Southern No. 2 seems to be firm at $11, Birmingham. Northern iron is unchanged in prices at Chicago and Ironton.

Coke

One sale of 100 tons of foundry coke was made last week. Shipment is for an early date. Connellsville 72-hour foundry coke is held at $2.65 to $3, ovens.

Old Material

Dealers in scrap iron are really optimistic, believing that a number of mills will resume operations immediately after the turn of the year, and that improvement with perhaps advancing prices, will take place.

John A. Nichols, superintendent of the open-hearth steel department of the Clairton works of the Carnegie Steel Co., at Clairton, Pa., on Jan. 1, became superintendent of the new steel plant of Corrigan, McKinney & Co., Cleveland.

The South Norwalk Engine Co., Stratford, Conn., has changed its name to the Bridgeport Engineering Co., and has removed to a new plant at Stratford from South Norwalk.

More Inquiry in the Chicago District

And Marked Improvement at a Not Far Distant Time is Expected—Decline in Prices Checked

BY H. COLE ESTEP

Office of THE IRON TRADE REVIEW, 1521-23 Lytton Bldg., Chicago, Dec. 30.

The opening of the new year finds the iron and steel interests in the west in an expectant frame of mind. Evidence is multiplying that the long period of declining prices is approaching its end, and in some few instances it is believed that there has already been a slight recovery from minimum quotations; this is true particularly of iron and steel bars. Inquiry for finished materials and pig iron is materially heavier. Railroads are showing a little more activity, although comparatively little business is expected from this quarter until the trunk line freight rate case is settled.

Pig Iron

Inquiry pending in the Chicago district aggregates approximately 22,000 tons. One of the most prominent sellers of northern iron has 14 inquiries totalling 11,000 tons, and it is expected that they will be turned into orders inside of two weeks. The activity is well distributed, and there are no very large lots under consideration. The heaviest single inquiry does not exceed 2,000 tons. Sales during the past week showed some improvement and December business in the aggregate, due to heavy buying two weeks ago, will exceed November by a comfortable margin. Prices are stationary and local furnaces are quoting from $14 to $14.50 for first half shipment. Owing to the large amount of idle capacity in this district, business must show a very decided improvement before prices can advance to any extent. Southern iron is hovering in the neighborhood of $15.35, Chicago, although some sales are being made at $10.75, Birmingham. The Republic Iron & Steel Co. has sold 750 tons of Pioneer iron in three lots at $11, Birmingham. The Illinois Steel Co. is considering lighting its idle stack at Milwaukee.

Merchant Bars

Inquiry for both iron and steel bars has improved slightly and current orders for the last week in December were in excess of the average for the preceding three weeks. The extent of the improvement, however, is not sufficient to afford much relief to the producers and it is not generally expected that business will show much material increase for a month or so. Soft steel bars are selling at from 1.33c to 1.38c, Chicago, the minimum being equivalent to 1.15c, Pittsburgh. Lower prices than these, which were made in some cases recently, have disappeared. The producers are uniformly disinclined to contract for more than three months at present prices, and some mills are asking $1 a ton above the prevailing minimum for this short period. One independent producer is willing to contract for six months at 1.20c, Pittsburgh, although no business of this nature is being actively sought. The hard steel situation shows practically no improvement. The Inland Steel Co. hopes to have enough orders accumulated so that it may reopen its Chicago Heights plant on Jan. 5. Some of the rerolling mills are refusing business at 1.25c, Chicago, although the 1.30c price is not attractive to consumers who are in a position to substitute soft steel. Bar iron is practically unchanged. Most of the iron and steel mills in this territory will run through the week, including New Year's day.

Plates and Structurals

Some fair inquiries for structural material are appearing, but very little of the prospective tonnage has yet developed into orders. Prices are unchanged with a minimum of 1.15c for plates and 1.20c, Pittsburgh, for shapes. The latter figure is more or less nominal and mixed orders can be placed at a flat price of 1.15c, Pittsburgh. A few railroad bridge orders have appeared recently for which the steel requirements will be furnished by the leading interest.

Rails and Track Fastenings

Some of the western railroads have offered to make contracts for their year's requirements of spikes, bolts, nuts and angle bars at prevailing prices. The serious consideration of such tenders is considered beyond the range of possibility by the mills, and no business has been transacted. Current orders for track fastenings are somewhat heavier. The Illinois Steel Co. has received a contract for 4,000 tons of standard rails from a western line for immediate delivery, and it is understood has practically closed another contract for 15,000 tons for early rolling.

Bolts, Nuts and Rivets

The rivet situation is sentimentally better and inquiries are a trifle heavier; prices are unchanged with a minimum of 1.83c, Chicago, for structural rivets and 1.93c for boiler rivets. Agricultural implement makers have not specified for the usual proportion of their annual contracts, and for this reason some makers feel that orders will be heavier during the first half of next year.

Sheets

Buying for immediate delivery at minimum prices is fairly liberal and approximately 85 per cent of the sheet-making capacity of this district is in service. Some contracts for three months are being made on a basis of 1.85c, Pittsburgh, for No. 28 black and 2.85c for the same gage galvanized sheets. It is understood that these figures have been shaded slightly on current orders. The Inland Steel Co. is operating 17 of its 18 hot mills this week, but expects to shut down 10 mills shortly for a period of six weeks while a new motor is being installed.

Wire Products

Contracts expiring with the year, in a good many cases, have not been fully specified and will undoubtedly be extended. No contracts for future delivery are being made at present prices. Shipments are light and mills are operating at only a fraction of their capacity.

Old Material

The general level of scrap prices has not changed in the past ten days, indicating that the long decline is nearly, if not entirely, ended. Quotations on many items are lower than they have ever been before. Large quantities of rerolling rails have been offered recently with the result that quotations have been shaded 25 cents a ton. Sales of rerolling rails of standard length are now being made at $11 to $11.50 per gross ton, f. o. b. Chicago. The heavy railroad offerings of last week have been generally absorbed and three new lists are out. The Baltimore & Ohio will sell about 10,000 tons on Jan. 5, a considerable portion of which will come to the Chicago district.

Steel Company Buys Basic in the East

For Delivery Over First and Second Quarters—Price Was Low—Pig Iron Market in Philadelphia District is Dull

Office of THE IRON TRADE REVIEW,
326 Real Estate Trust Bldg.,
Philadelphia, Dec. 30.

On the whole, the pig iron market is dull and comparatively little tendency is manifested to close for forward requirements. Pig iron makers, however, feel a little better as regards the future than they did a while back. The most interesting development of the week was the purchase, by the Lukens Iron & Steel Co., of a round tonnage of basic, for delivery over the first and second quarters. Details of the transactions are not available and reports of the size of the tonnage vary all the way from 7,500 tons to 25,000 tons. The price is said to have been more than $14 and not more than $14.25, delivered. An inquiry has come into this market from a New England consumer, who wants from 3,000 to 5,000 tons of special analysis basic for second quarter delivery. An inquiry for 1,000 tons of basic for a local consumer remains unacted upon. Several inquiries for foundry iron have been received from consumers in this territory. These involve from 100 to 500 tons respectively. No developments are noted in malleable, and a local consumer continues to inquire for 400 tons for January delivery. A Lynchburg, Va., pipe maker has not yet acted on its inquiry for 5,000 tons of No. 3, No. 4 and forge. The United States Cast Iron Pipe & Foundry Co. has closed for a small tonnage of low-grade iron. Lebanon low phosphorus continues to sell in small lots at $18, furnace. High grade low phosphorus has been selling in fair quantities at $21 to $21.50.

Semi-Finished Material

A New Jersey consumer of billets has closed for 3,000 tons for forward delivery. There is little activity in the billet market and prices are unchanged.

Iron and Steel Bars

Some steel bar business for future delivery has been booked this week, but in general buyers continue chary about placing their forward requirements. On contracts, most sellers ask 1.45c to 1.50c, Philadelphia, for the first six months, but at least one seller will do 1.40c, and probably 1.35c. The prompt price is 1.20c to 1.25c, Pittsburgh, or 1.35c to 1.40c, Philadelphia. Common iron bars are in little demand and are held at 1.22½c to 1.27½c, delivered to consumers' plants in this locality.

Plates and Shapes

Eastern makers of plates continue to quote 1.35c to 1.40c, Philadelphia, and a good business in a small way has been done at this figure. Middle western makers quote on a basis of 1.20c, Pittsburgh. There are fewer requests for lower prices on the part of buyers and there is more contract business. The Lukens Iron & Steel Co. will resume operations on Monday and will continue without a shut-down over New Year's day. No improvement has been manifested in the demand for structural shapes. The lowest price heard of so far, as having actually been done, is 1.20c, Pittsburgh. There is little inquiry.

Sheets

Inquiries for prices on large tonnages have been put out by some buyers of sheets, but the latter appear not to be anxious to close at the prices which makers demand. Although 1.35c, Pittsburgh, is heard of, 1.40c to 1.45c, Pittsburgh, or 1.55c to 1.60c, Philadelphia, for No. 10 gage, blue annealed, seems to be more fairly representative of the market.

Old Material

Sales of wrought pipe have been made in eastern Pennsylvania territory at $9, delivered consumers' plants, and this grade is now quoted at $8.75 to $9.25. On the whole, the market is very dull in all grades and demand continues at a minimum. The undertone is somewhat improved, however, due to greater willingness on the part of consumers to talk about their requirements.

Good Feeling Prevails at Cincinnati

But Pig Iron is Inactive and $11 Price is Cut—Large Tonnage of Coke Sold to Southern Ohio Furnaces

BY S. G. BACKMAN

Office of THE IRON TRADE REVIEW,
503 Mercantile Library Bldg.,
Cincinnati, Dec. 30.

The pig iron market is apparently awaiting the first of the year before resuming activities. Sales and inquiries in this territory are at present very limited as to tonnages, and are generally for immediate shipments, although some large inquiries are reported pending in adjoining districts, for first half delivery. There is a feeling of optimism prevailing among the trade in general as to the immediate future of the market, but this is probably more because of sentiment at the approach of the new year than from any definite developments, as nothing has transpired recently that would indicate better conditions. It is well-known, however, that a large number of melters have not as yet covered for first half requirements, but it is only problematical as to whether or not they will continue to buy from hand to mouth after the first of the year, as they have been doing during the past six months, or whether or not the present low prices will bring out a larger volume of buying.

Southern No. 2 foundry iron is being generally held at $11, Birmingham basis, for first half shipment, but it is known that two southern furnaces have recently sold at $10.50, Birmingham, for first quarter delivery, and it is quite likely that more could be had at this figure.

The prevailing price for southern Ohio No. 2 foundry iron is $13, Ironton, for either spot or first half shipment. Rumors of $12.50, Ironton, iron are frequently heard, but are entirely unverified. A large near-by melter is reported to be in the market for a considerable tonnage of basic iron ranging from 10,000 to 20,000 tons.

Finished Material

Warehouse business is very quiet and a resumption of buying is not expected until after the holiday season. The month of December has been unusually dull and has suffered a decline of about $2 a ton, which occurred about two weeks ago. Prices at the present time are holding fairly well, although blue annealed sheets and cold rolled shafting have weakened a little within the past few days, the former being now more generally quoted at from 2.05c to 2.10c for No. 10 gage, and the latter at from 55 to 58 per cent off on round, square, hexagon and flat shafting. Prices on

steel bars, iron bars and plates and shapes are unchanged.

The local sheet mill has resumed operations after a slight shut-down during the holidays, in order to take an inventory of stock. The mill is receiving satisfactory specifications for both spot and contract delivery and is holding at the following prices: Black sheets No. 28 gage, 2.05c to 2.10c, and galvanized sheets, No. 28 gage, 3.05c to 3.10c.

Coke

Close to 100,000 tons of coke has been sold to southern Ohio furnaces within the past eight or ten days for first half shipment, most of which will come from the Pocahontas fields. Prices in these sales are reported to have ranged from $2 to $2.10 per ton, ovens. These figures are slightly below those that have been quoted as the general market level. Pocahontas prices have been rather uncertain for some time, as a number of operators have not been actively soliciting business. This is also true of Wise county coke where 48-hour grades are now being offered at from $2.10 to $2.25 per ton, ovens, for either spot or contract shipments. Contract furnace coke from the Connellsville district is given at from $1.95 to $2 per ton, this slight increase being due to the better buying movement that has been recently experienced. New River coke is unchanged, as most of the output from this district is contracted for. Foundry coke from all of the producing districts is also reported unchanged from last week.

Old Material

The close of the year finds the scrap iron market in a very unsettled condition with buying and selling practically at a minimum. There is no general level of prices because there are not enough transactions to form a basis of comparison and as a result quotations are being adjusted to suit each particular transaction. Most of the sales are for small lots for prompt delivery and but very little scrap is being moved on contracts.

About sixty members of the Refractories Manufacturers' Association were entertained last week by the Harbison-Walker Refractories Co., Pittsburgh. A luncheon was served at the Fort Pitt hotel, after which the plant at Hays Station, Pa., was inspected.

The Barco Brass & Joint Co., Chicago, has bought a four-story and basement building, 100 x 125 feet, at 212 West Illinois street. The company's business will be carried on in part of the structure.

HOLIDAY SPIRIT

Dominates New York Market—Very Little New Business Pending.

Office of THE IRON TRADE REVIEW,
503-4 West St. Bldg.,
New York, Dec. 30.

The eastern pig iron market is dominated by the holiday spirit and very little new tonnage is under negotiation. New business has not come out in sufficient volume to determine whether or not the market is at the bottom. A better feeling prevails among sellers, however, who are of the opinion that the ushering in of the new year will be accompanied by an improved demand on the part of buyers. Included in this week's business is the purchase of 200 tons of special foundry iron by a New England consumer. Another New England consumer is in the market for 100 tons of foundry iron and a Connecticut consumer is inquiring for 200 tons of high silicon iron. A New Jersey consumer has sent out an inquiry for 400 tons, including 200 tons each of high silicon and low silicon. A soil pipe maker continues to negotiate for 5,000 tons of low grade iron for delivery at plants in New Jersey and up state. No formal inquiries have yet developed from the large New England buyers of malleable who last week were reported as sounding the market.

Ferro-Alloys

Sellers of ferro-manganese are inclined to wait for future developments, owing to the action of the United States Steel Corporation in becoming a seller of ferro-manganese. There are numerous inquiries in the market at present, but none of these involve more than 50 or 100 tons. Consumers are not expected to close for their forward requirements until the market has become adjusted to the new conditions. At present, ferro-manganese may be quoted at $47, seaboard. There is a rumor that the price of ferro-silicon is to be shaded after the first of the year.

Plates and Shapes

There are pending several fair-sized tonnages of plates, which are fairly large in the aggregate. It is expected that some of these will be closed within the next week or two. The good bookings of the last few weeks have served to create a better feeling among plate makers, most of whom believe that present prices soon will harden. Eastern makers will quote no lower than 1.25c, Pittsburgh, while middle western makers are quoting 1.20c, Pittsburgh, as the minimum. Plate makers show less anxiety to contract for forward requirements at the present prices.

There has been a slightly better demand for shapes. The aggregate booked, however, continues small. In the absence of large tonnages, it is not known how low a price mills might be tempted to offer. The minimum quotation offered by some makers continues to be 1.20c, Pittsburgh. There is less anxiety among makers to contract and some mills will not book deliveries beyond the first quarter at prevailing prices.

Cast Iron Pipe

The last week of the old year has been attended by the bringing out of considerable new business by municipalities which are in the habit of entering the market at this time of the year. A feature of the demand, however, is that the requirements under negotiation are small, compared with those of other years. Numerous gas and water companies are sounding the market. Prices are showing some tendency toward hardening. While the low bidders on contracts offering continue exceedingly low, there is a general tendency toward higher quotations. The city of Schenectady has let about 1,500 tons of 36-inch pipe to R. D. Wood & Co. at $22.10, delivered. F. A. Houdlette, Boston, was the low bidder on 650 tons of 6 to 16-inch pipe for the city of Hartford, Conn., at $21.70 to $22.70, delivered. The city of Troy, N. Y., will open bids on Jan. 2 on 6,100 tons of 30-inch pipe. Eastern makers are bidding on 3,290 tons of 6 to 30-inch pipe for St. Paul, Minn., bids to be opened Jan. 12, and on 12,000 tons of large pipe for Chicago, bids to be opened this week. Bids were opened at Mount Morris, N. Y., on Dec. 26, on 1,523 tons of 10 and 12-inch pipe. At Providence, R. I., bids will be opened Jan. 5 on 780 tons of 4, 6 and 12-inch pipe. The Brooklyn Union Gas Co., Brooklyn, N. Y., will open bids Jan. 2 on about 5,000 tons of 4, 6, 8, 10, 12 and 16-inch pipe, most of the tonnage being 6-inch. The Consolidated Gas Co., New York, is taking bids until Jan. 7 on 900 tons of 6 to 12-inch pipe. Bids were opened at Lawrence, Mass., on Dec. 26 on 130 tons. The city of Baltimore let 1,155 tons of small pipe to the United States Cast Iron Pipe & Foundry Co., at about $21.50, delivered.

Old Material

The old material market in this territory continues without life and no improvement is expected until after the first of the year. There is absolutely no inquiry from consumers and prices continue nominally unchanged.

CLEVELAND OPTIMISTIC

As the Old Year Ends, in Spite of Some Very Low Prices.

BY GEORGE SMART

Office of THE IRON TRADE REVIEW,
Penton Bldg.,
Cleveland, Dec. 30.

Ore shippers had at this time last year sold all the ore that they could promise to deliver during 1913. Today neither shippers nor furnace interests are considering their requirements for 1914 and two months may elapse before the subject is taken up. Trade developments during the interim will determine what is to be done. Information from Duluth is to the effect that the Oliver Iron Mining Co. shipped 24,552,200 tons during 1913, which is practically one-half of the season's movement. The lake fleet moved 49,070,478 tons during 1913. It is understood to be the intention of the company to mine its full quota of 6,000,000 tons from the Hill properties during 1914, the lease upon which expires Dec. 31, 1914, but further than that no plans have been formed. At the present outlook, it would appear that less ore would be mined during 1914 than 1913. At least that is the opinion of those closest to the trade; but it has been the history of the iron trade that those closest to judge have frequently been the least correct in their predictions of the future.

Pig Iron

Very low prices continue to be made for delivery at distant points, as low as $12.75, furnace, being quoted on No. 2 foundry, and even a lower price on basic. The Cleveland Furnace Co. will blow out one of its stacks this week. The order books of the company are in very good condition for one stack. Cherry Valley is about to blow in.

Coke

Firmness in the market continues and furnaces are finding it difficult to shade $2, but this has been done by a few cents by a Cleveland firm. On foundry coke, $3 is being quoted on Rainey coke, but first-class coke can be obtained at $2.75. Foundries are showing some interest in the market.

Finished Materials

The tone of the market for finished materials is optimistic at the close of the year and buyers are frequently more anxious to make contracts than are sellers. At the same time, some very low prices are heard of. On rivets, for example, 1.60c is now quoted on structural and 1.70c on boiler rivets, a decline of $2 below recent nominal quotations. On sheets, the very low quotations recently made still prevail. On steel bars, 1.20c, Pittsburgh, is the usual quotation, but reports of 1.15c are heard. A sale of 6,000 tons of billets has been made to the Kokomo Steel & Wire Co. Bar iron is dull, but Cleveland mills have enough orders on hand to justify them in resuming operations next Monday.

A Cleveland company which has been in the market for several thousand tons of billets and was willing to pay $20, maker's mill, has been quoted $21 by a maker outside of Cleveland on 300 tons. A warehouse to be built by a hardware company will require 2,200 tons of reinforcing bars.

Old Materials

Dullness has prevailed during the holiday season in the scrap market. No business is passing for immediate shipment in this district and comparatively little for future delivery, with the exception of one or two firms, which have covered their requirements for the first quarter. It is thought the next 10 days will bring forth orders for this period from a good many consumers. Heavy steel is still quoted $9.50; dealers covering short sales and filling old contracts are paying more than the regularly quoted price to the consumer, that is, around $9.75. The slackening in iron and steel lines is beginning to be felt in the productive as well as the consuming end of the scrap business, for with shops running about 50 or 60 per cent of capacity, not nearly so much scrap is brought out.

IMPROVED SENTIMENT

At Buffalo in Pig Iron and Finished Materials.

BY FRANK R. DOLBEE

Office of THE IRON TRADE REVIEW,
Buffalo, Dec. 30.

The transactions of the week were minimized by the holidays, and notwithstanding the low ebb of shipments, contracts and the below-production base schedules, it is confidently believed that the settlement of the currency legislation by the enactment of the new law is to have an early strengthening influence on the market. There has already developed within the past several days a number of inquiries for pig iron, which reflect a return of confidence. All of the interests of the district report an improved sentiment among the trade. Many of these inquiries are expected to crystallize into placements that will add to the sales total for the year, before it closes. Prior to this change, the only ordering proved to be in carload lots of various grades. The producing interests of the district all say that the enactment of the currency act has caused already an improvement in collections. There is no change in the price schedule of last week, although quotations are not classed as firm, but the furnaces say no further declines are expected, but look instead to the development of an advancing tendency within the early weeks of the first quarter of the new year.

Finished Material

All of the mills and agencies of the district report an improvement in sentiment, and are now looking for a general resumption of buying in practically all lines of mill products, to develop shortly after the opening of the first quarter of 1914, or after the inventory period has been passed. It is also expected that this buying movement will reach considerable proportions, and the return of confidence is based largely upon the passage of the administration's currency act. The Lackawanna Steel Co. has now in commission 11 of its 14 open-hearth furnaces in plant No. 1, most of which have been out some time for repairs.

Attractive tonnages for immediate delivery are being placed at 1.20c, base, on bars, shapes and plates, while 1.25c to 1.30c, base, is being asked and obtained for small lots. There is no disposition on the part of the producers to book futures at these figures. While trading in wire and wire products has been restricted on account of the holidays, an improved tone is noted.

The fabricators of the district report that operations at the present time are only nominal but that the outlook for the first and second quarter and beyond of 1914 is considered very good, because of the number of projects on the boards, which are definitely scheduled to materialize after the turn of the year.

Old Material

There has been no change in the schedules quoted a week ago, but a decided improvement in sentiment and activity in the scrap market of this district. Fully 4,000 tons of heavy melting steel were placed at $9.50 to $10. There is also considerable activity in borings and turnings. All of the yards report a better feeling among the consumers. It is figured that the price bottom has been reached and that the next change to be recorded will show a strengthening tendency. This is already forecasted by the disposition of the dealers to book only limited orders at prevailing prices.

James McGrath was elected president of the Connellsville Machine & Car Co., Connellsville, Pa., at a recent meeting of directors. Other officers elected were: Grant Myers, vice president, and J. W. Ralston, secretary and treasurer.

Great Britain Looks to United States

Hoping for Harmonious Relations With American Manufacturers—Improvement in Pig Iron and Finished Materials

BY J. HORTON

Office of THE IRON TRADE REVIEW,
Prince's Chambers, Corporation St.,
Birmingham, Eng., Dec. 20.

There are signs that the turn of the tide has come in the pig iron market as a fairly large number of contracts have been arranged in most districts, but there is still great caution exercised on both sides. Consumers show a greater inclination to cover their spring requirements. The immediate effect of this has been a slight rise in price transactions, these being on the basis of 50s ($12.24) for Cleveland warrants, while an advance is asked for future business. There are no heavy contracts, makers being determined to hold out for better prices for next year's business. At Birmingham on Thursday, a number of the smelters reported themselves "off the market". They state that present prices are unprofitable, and that they will not accept heavy commitments. They prefer to wait for the higher prices which, they are confident, will be obtainable in the new year. The shipments of pig iron for November are about up to the average, being 44,000 tons up to the present time. The stock also continues to decrease, and now stands at 142,000 tons.

Brisk Buying Movement in England

(By cable to THE IRON TRADE REVIEW.)

Birmingham, Eng., Dec. 29.—The pig iron market is satisfactory. A brisk buying period has commenced. Prices are firm and improving. Many makers are holding off for better prices. Some forward business has been done at a shilling to two shillings advance. At present rates, the hematite price shows marked improvement. The Barrow market is showing new life. Steel makers, shipbuilders and engineers are known to require big deliveries of metal. Alloys are scarce. Galvanized sheets are a pound per ton above the recent minimum. J. HORTON.

Finished Iron and Steel

In finished lines the event of the week has been the re-establishment of the Galvanized Sheet Association, after an interval of four years. The negotiations are reported to have been entirely successful, as all the British makers, including those in Scotland, will be enrolled. The agreements have not been signed, but it is hoped they will be by the end of the year. In view of the success of international steel control, there has been some talk of approaching American makers. It is recognized that, since the last association existed, great progress has been made by America, and that the real competition in the South American and West Indian markets comes from American makers. But for the present British makers are going forward themselves. The outlook is considered favorable, in view of the very large production of the year. It is now clear that the year will be a record one, inasmuch as the total export for the 11 months to the end of November amounted to 700,540 tons, an increase of about 100,000 tons, as compared with the same period last year. The makers are very well satisfied with their foreign markets, and they are especially pleased with the steady increase in the Indian and Colonial demands, which have grown from 213 tons in 1908 to 400,000 in 1912. It is significant that, for the present, no price regulation has been entered upon, and this may be postponed for some little time, partly because makers are rather heavily committed for some months forward; but still more out of respect to possibilities in the way of foreign competition. For the present, the only thing agreed to is the decision to restrict output to a recognized amount at each of the works, penalties being imposed for excessive production, these fines to be payable to those who produce below their qualification. Due attention has been paid here to the fact that at the present time American makers of galvanized sheets are complaining of low and unprofitable prices; also to the increased ability given by tariff reduction to American makers to make a stronger showing in the open markets of the world.

INCREASED INQUIRY

Noted at Birmingham With More Buying of Pig Iron.

Office of THE IRON TRADE REVIEW,
Birmingham, Ala., Dec. 30.

The inquiry for pig iron for the past week, notwithstanding the Christmas holiday season, has been greater than for the last four to six weeks. This came from a wide range of territory, but almost entirely from non-competitive points. Of course this activity tends to strengthen the market, and naturally the sales managers of the several furnace interests are more optimistic. As a result of the week's sales, an aggregate of 9,200 tons has actually been entered upon order books. All of this tonnage is for prompt delivery, and the bulk of it came from southern territory. The tonnage entered is divided about as follows: Four thousand tons in carload lots and up to 200 tons; 4,000 tons in lots varying from 200 to 400 tons; 1,000 tons in two lots of 500 tons each; 200 tons of special analysis iron. All of this was entered at figures varying from $11 to $11.50 per ton for No. 2 foundry, f. o. b. Birmingham, and in no case was there reported a sale at figures lower than these. The price of the high manganese iron was from $12.50 to $13 at Birmingham, analysis governing. The Tennessee Coal, Iron & Railroad Co. is reported to have sold some 4,500 tons of foundry iron to be exported to Mediterranean ports, and it is generally believed that an additional lot of some 20,000 tons was also sold within the week. However, a definite confirmation of the sale cannot be obtained at this time. It is evident from recent sales that both the larger and smaller consumers have been buying for their immediate requirements only, and it is the general consensus of opinion of producers that not more than 15 per cent of the requirements for the first quarter of next year has been taken care of. Such being the case, it is reasonable for the furnace interests to expect a greater buying activity with the beginning of the new year.

The scrap market is without further development, and operations are still being confined to the movement of contracted tonnages.

Improvements at Plant of the Inland Steel Co.

Description of the New Shear Plate Mill, By-Product Coke Ovens, Coal-Handling Equipment, New Power Units and Auxiliary Machinery Installed

IN THE management of a steel plant, the diversification of output and the control of raw materials are two factors of primary importance in insuring economical operation. The truth of this statement is attested by the history of every important steel company in the country. A diversified product helps to reduce costs through increasing the tonnage and cutting down the overhead, administrative and selling expenses, which are more or less fixed, with only a nominal relation to the character of the output. Diversification is also of the utmost importance in insuring a steady rate of production and in providing an outlet for tonnage in dull times. The control of raw materials is equally powerful in reducing the unit costs of steel-making through the elimination of duplicate organizations with their accompanying fixed expenses, the avoidance of unnecessary profits and the assurance of a dependable supply of primary products at all times.

Ever since the construction of its Indiana Harbor works in 1901, the Inland Steel Co., Chicago, has consistently pursued a policy of diversifying its output and strengthening its control of raw materials in order to effectively meet the severe competition of modern times by low operating expenses. With this end in view, a blast furnace was added to the plant in 1906, ore lands were acquired on the Mesabi and Cuyuna ranges, a fleet of ore steamers was constructed, a bolt, nut and rivet department was added in 1911 and a second blast furnace in 1912. The bolt and nut department was described in THE IRON TRADE REVIEW, Sept. 28, 1911, and the new blast furnace May 9, 1912.

To these improvements there recently have been added a new shear plate mill, a by-product coke oven plant, special coal-handling facilities, two exhaust steam turbine units and other auxiliary equipment, which will be described in this article. Coal lands have also been acquired. The new plate mill will enable the Inland Steel Co. to add a full line of car and tank plates to its already extensive output, while the coke ovens will permit a material reduction in fuel costs through the utilization of the gas and the sale of by-products.

To provide the additional steel necessary for the new plate mill, four new 60-ton open-hearth furnaces have been constructed, making a total of 12, with a maximum steel-making capacity of 700,000 tons a year. The other auxiliary improvements include a concrete dock with two coal-unloading towers, a coal storage yard, a double-track hot metal tunnel between the blast furnaces and the steel plant, additional direct current electric generating capacity and the conversion of the open-hearth and sheet mill furnaces from fuel oil to producer gas and coal, respectively. The latter change was made necessary by the uncertainties surrounding the supply of oil. The general arrangement of the blast furnaces, dock, coal storage and coke oven departments is illustrated in Fig. 13. This illustration also shows how space has been provided for two additional blast furnaces to be erected in the future.

The new 90-inch, three-high, motor-

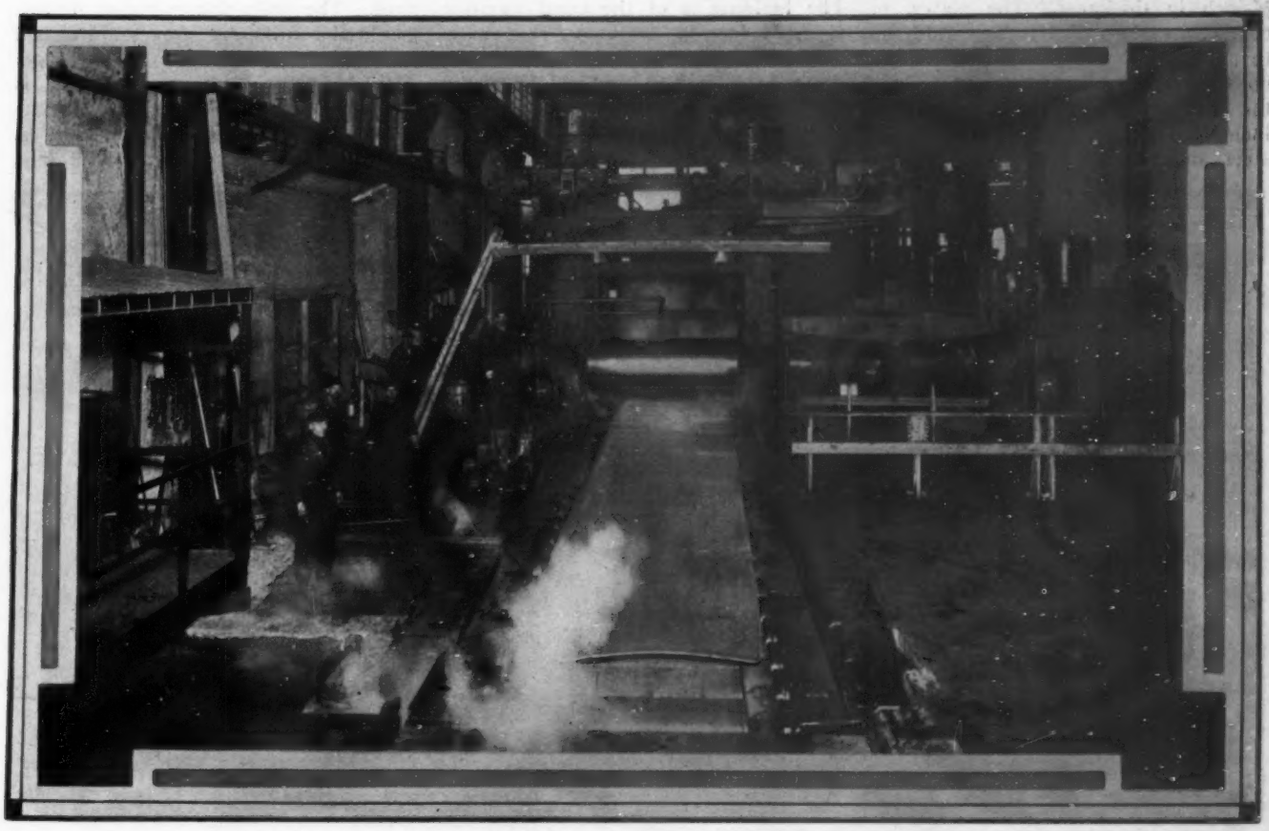


FIG. 1—DELIVERY SIDE OF THE 90-INCH PLATE MILL INSTALLED BY THE INLAND STEEL CO.

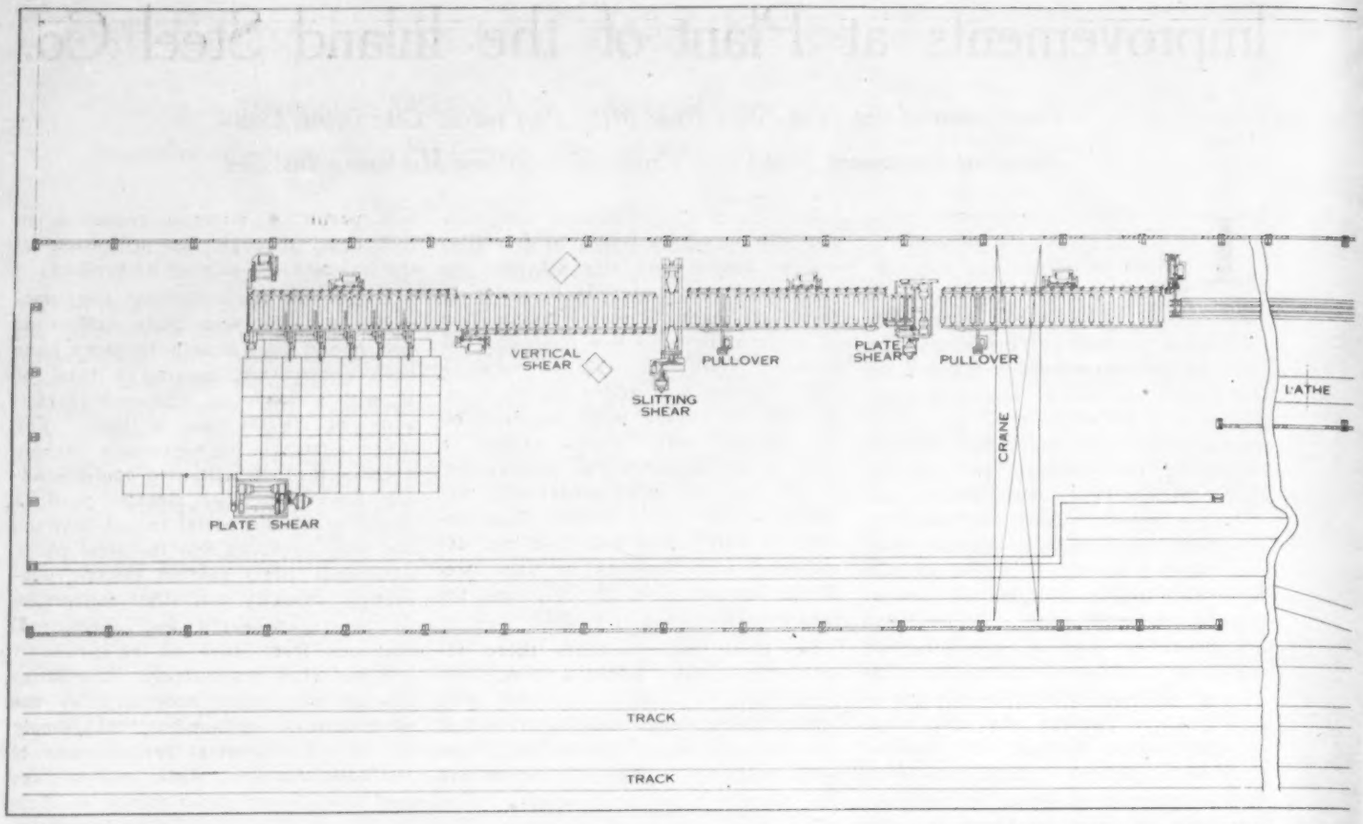
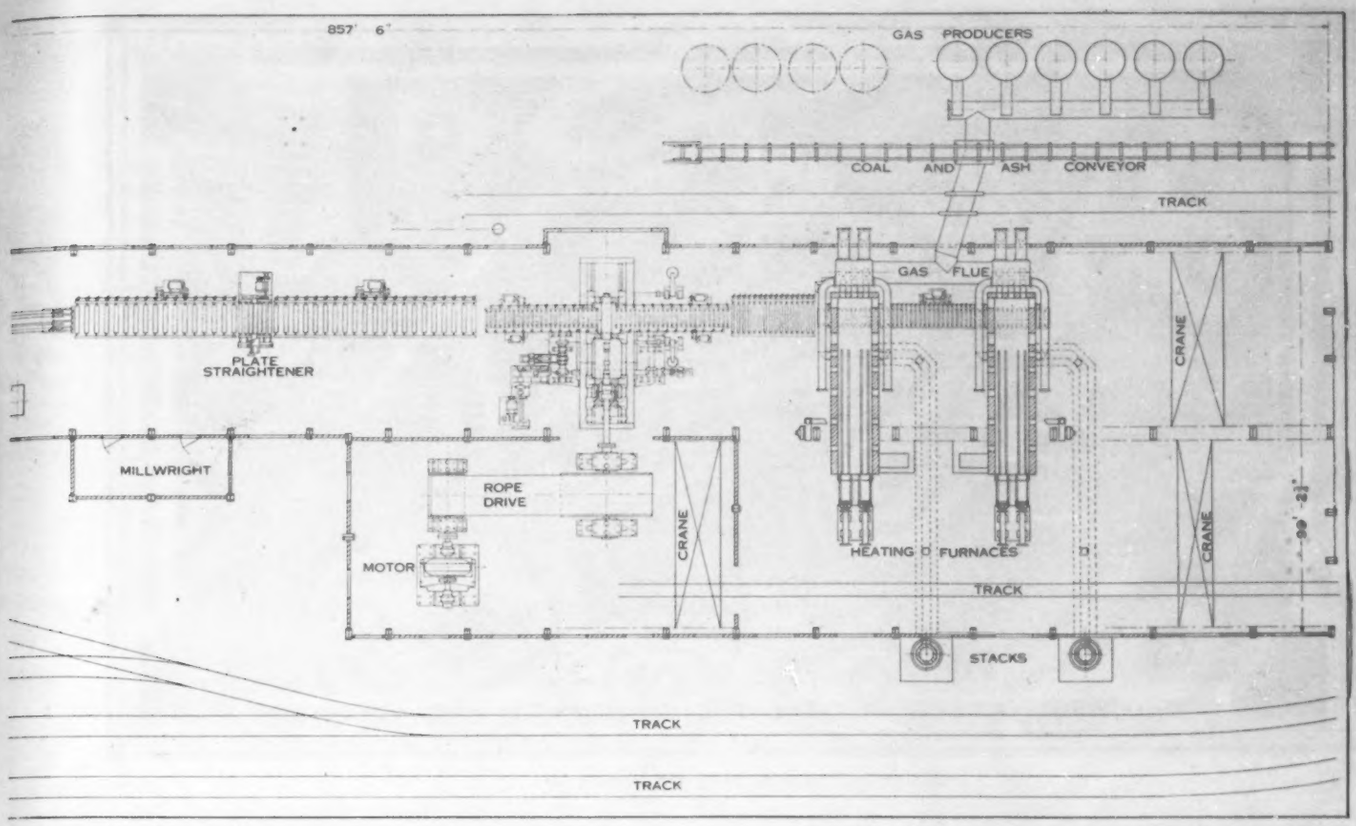


FIG. 2—GENERAL LAYOUT OF THE PLATE

driven shear plate mill has a capacity of 450 tons per 24 hours and is designed to roll plates from 8-gage to ¼-inch in thickness. The plates, of course, may be rolled to any width up to about 80 inches and to any length up to 40 feet. At the present time, the largest plates rolled are ¼ x 72 x 480 inches. The new mill is housed in a steel and concrete building, 857 feet in length and 100 feet in extreme width, situated near the western edge of the Inland Steel Co.'s property. The building is of the usual monitor type, 34 feet in height to the eaves. The width of the structure is cut down to 50 feet in the middle, where the cooling conveyor is situated.

Ingots, 22 x 24 inches in cross-section, are rolled to slabs from 3 to 5½ inches in thickness in the blooming mill and are delivered to the receiving end of the new mill by the yard railroad. The slabs are reheated in two gas-fired continuous furnaces, furnished by Alex Laughlin & Co., Pittsburgh. The location of these furnaces is shown in Fig. 2, which also gives the general layout of the entire mill. A 10-ton crane with a span of 48 feet,

FIG. 3—GAS-FIRED, CONTINUOUS HEATING FURNACES



MILL INSTALLED BY THE INLAND STEEL CO.

furnished by the Alliance Machine Co., Alliance, O., transfers the slabs from the cars to the charging tables of the furnaces by the means of a magnet.

Each heating furnace is approximately 45 feet in length and 12 feet in width over all, with 18-inch walls. The slabs are shoved through from one end to the other by two hydraulic pushers. Until they reach the magnesite hearth near the discharge end of the furnace, the slabs are carried on four water-cooled pipes, approximately 30 feet in length. The furnaces discharge the slabs onto the approach table of the mill. Gas for the furnaces is generated in six 10-foot Laughlin producers with a rating of 12 tons of coal per 24 hours each. The producers are located just outside the mill building. An electric-driven conveyor brings the coal to the producers and carries away the refuse. The gas from the producers is delivered to a manifold, from which it is conveyed to the furnaces in a steel main having an external diameter of 5 feet, 9 inches. The furnaces are of the non-regenerative type and the

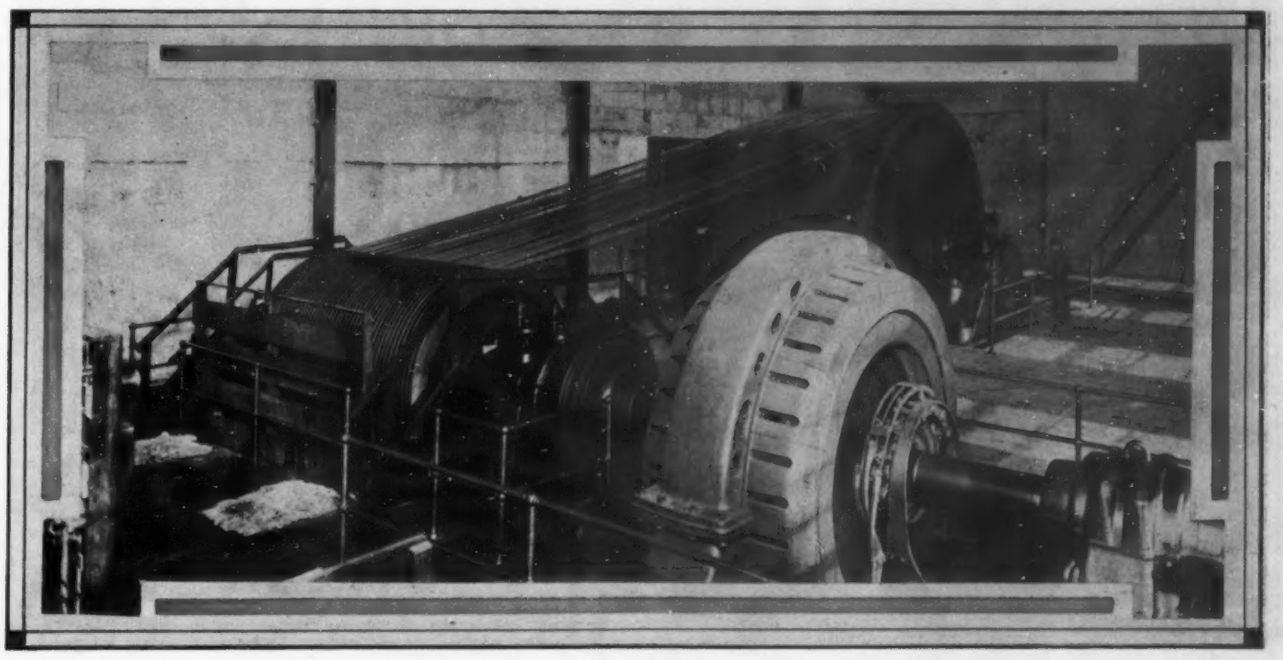


FIG. 4—WESTINGHOUSE MOTOR, 2,000-HORSEPOWER CAPACITY AND ROPE DRIVE

FIG. 5—APPROACH SIDE OF PLATE MILL

waste heat is discharged through two underground flues, which communicate with stacks 4 feet, 8 inches in inside diameter and 125 feet in height.

The furnace table delivers the reheated slabs to the mill approach table and from this point to the tilting table, as is shown in Fig. 2. The mill and its appurtenances, except the rope drive, was furnished by the United Engineering & Foundry Co., Pittsburgh. The drive was furnished by the Mesta Machine Co., Pittsburgh. The mill is designed to operate at a constant speed of approximately 51 revolutions per minute and at this rate can roll 450 tons per 24 hours. In making a plate ¼ x 72 x 480 inches from a slab 6 inches thick and 22 inches wide, about 17 passes are required; for a plate ½ x 72 x 188 inches,

FIG. 6—GENERAL VIEW OF THE FINISHING DEPARTMENT

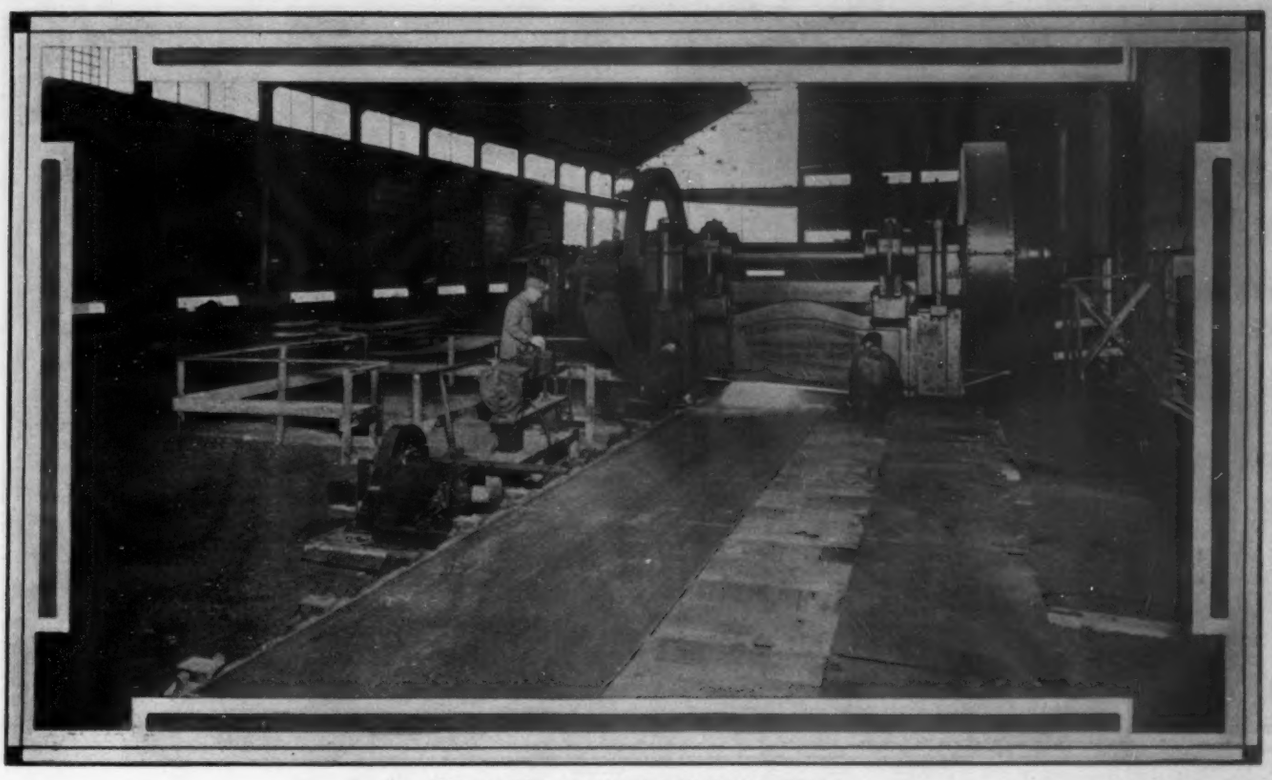


FIG. 7—THE 110-INCH SQUARING SHEAR

rolled from a 5½-inch slab, 11 passes are necessary. The 6-inch slabs are approximately 80 inches long and weigh about 3,000 pounds; the 5½-inch slabs used for rolling ½-inch plates are 22 inches wide and 70 inches long. As previously mentioned, they are bloomed down from 22 x 24-inch ingots.

The roll housing is cast steel of rugged design. The top roll is controlled by an electric-driven screw down, the middle roll by hydraulic gear, while the bottom roll is fixed. All the rolls are of chilled iron, the top and bottom rolls being 32 inches in diameter and 90 inches long with 23-inch necks, while the middle roll is 22 inches in diameter with a 15-inch neck. The screw down motor, which was furnished by the Westinghouse

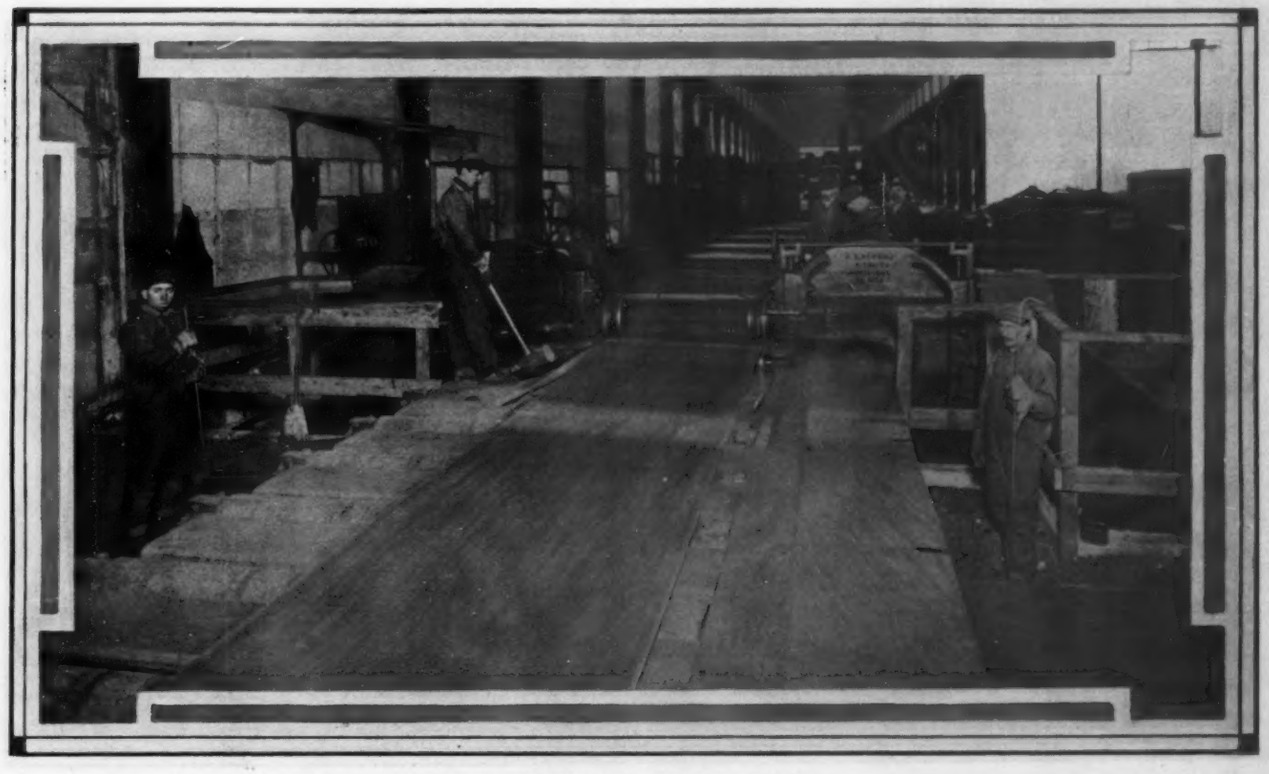


FIG. 8—NEWBOLD ROTARY SHEARS

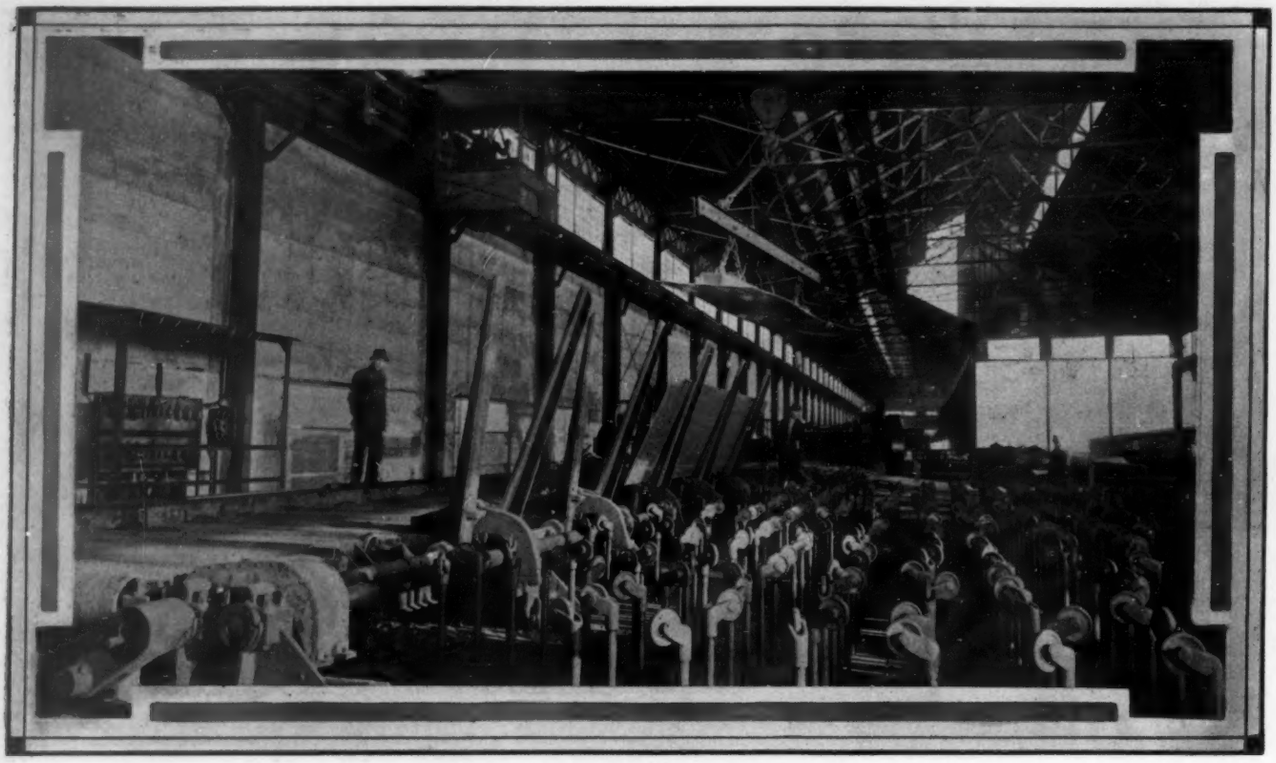


FIG. 9—PLATE TURNING DEVICE

Electric & Mfg. Co., is mounted horizontally on the top of the housing. It is rated 37½-horsepower at 535 revolutions per minute and runs on 220-volt direct current. The mill is equipped with the usual hydraulic manipulators.

The pinions are provided with helical cut teeth and are expected to be an important factor in the economical operation and smooth running of the mill. The efficiency of cut teeth is much greater than that of ordinary cast teeth and their use is growing. The pinions are not shrouded, but are provided with collars. The width of face is 20 inches. The middle or driving pinion is 22 inches pitch diameter with 11 teeth, and the top and bottom, or driven pinions are each 34 inches pitch diameter with 17 teeth. The circular pitch is 6.283 inches. The pinions are cast from 0.60 carbon steel with manganese ranging from 0.60 to 0.70 per cent.

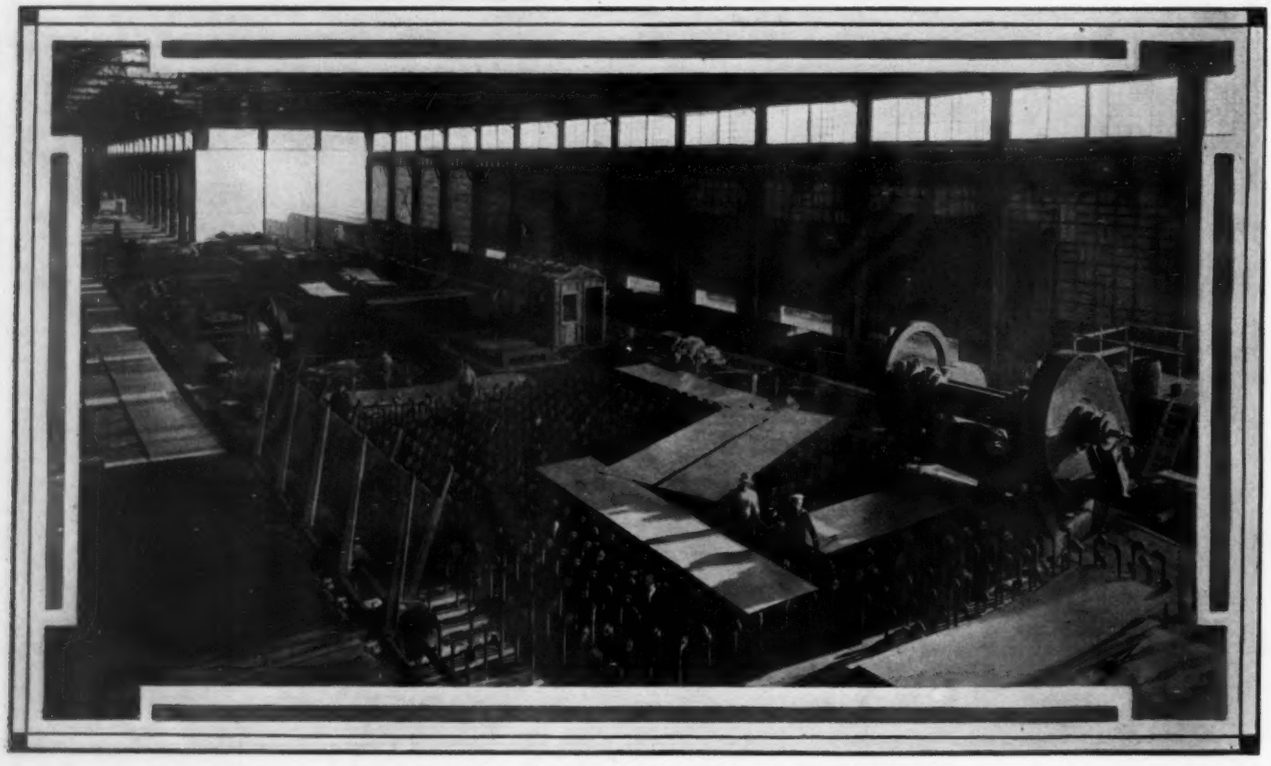


FIG. 10—CASTER TABLE AND 110-INCH SLITTING SHEAR

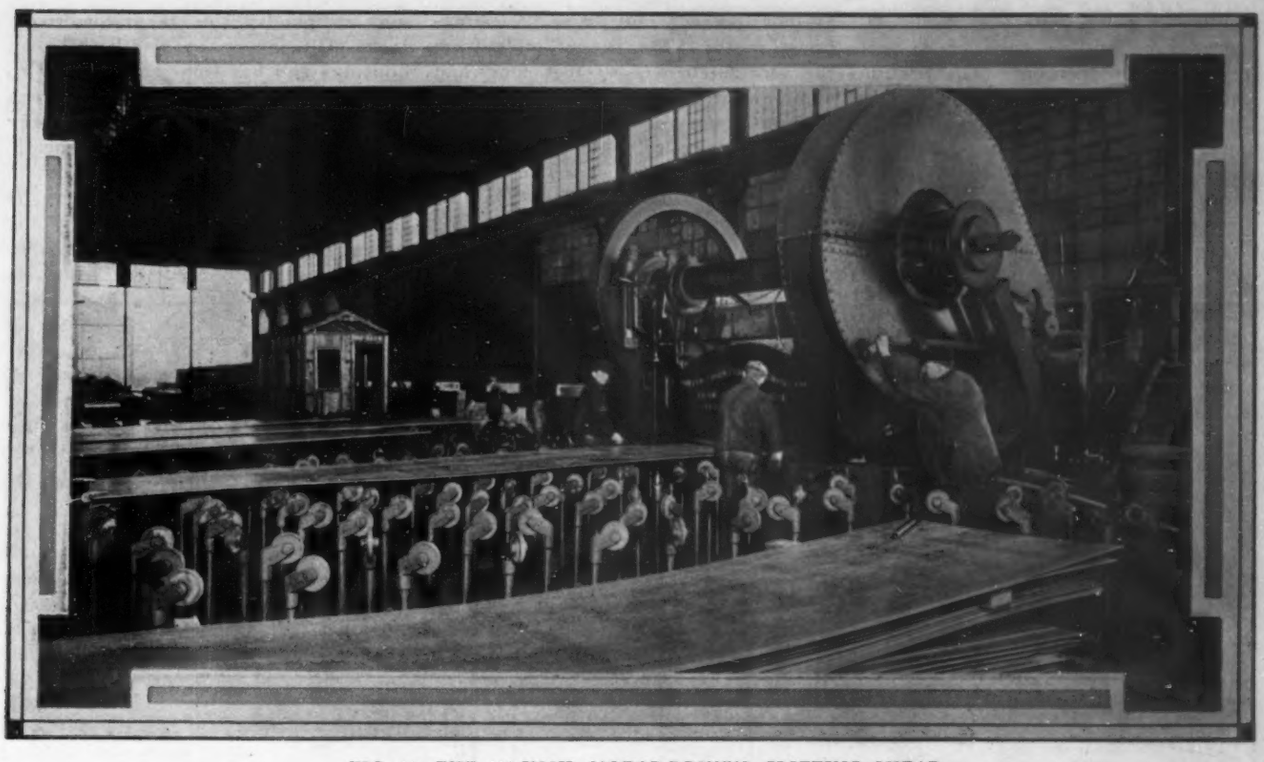


FIG. 11—THE 110-INCH, MOTOR-DRIVEN, SLITTING SHEAR

Power for operating the mill is furnished by a 2,000-horsepower Westinghouse constant speed, 3-phase, 25-cycle, 2,200-volt motor, running normally 245 revolutions per minute. The minimum and maximum speeds of the motor are 212.5 and 250 revolutions per minute, respectively. The motor is connected to the pinion shaft through a drive consisting of 44, 2-inch ropes, arranged as indicated in Fig. 2. The rope pulleys are 40 feet apart, center to center; the driving pulley is 7 feet, 4½ inches in pitch diameter and the driven pulley is 23 feet. The large pulley weighs 230,000 pounds, the rim alone weighing 124,500 pounds. At 80 revolutions per minute, the rim velocity is 5,780 feet per minute and the energy is equivalent to 20,400,000-foot pounds. From the data given, namely a motor speed of 245 revolutions per minute, pulley diameters 88½ and 276 inches, respectively, with pinions 22 and 34 inches pitch diameter, the normal speed of the rolls may be readily computed to be 50.8

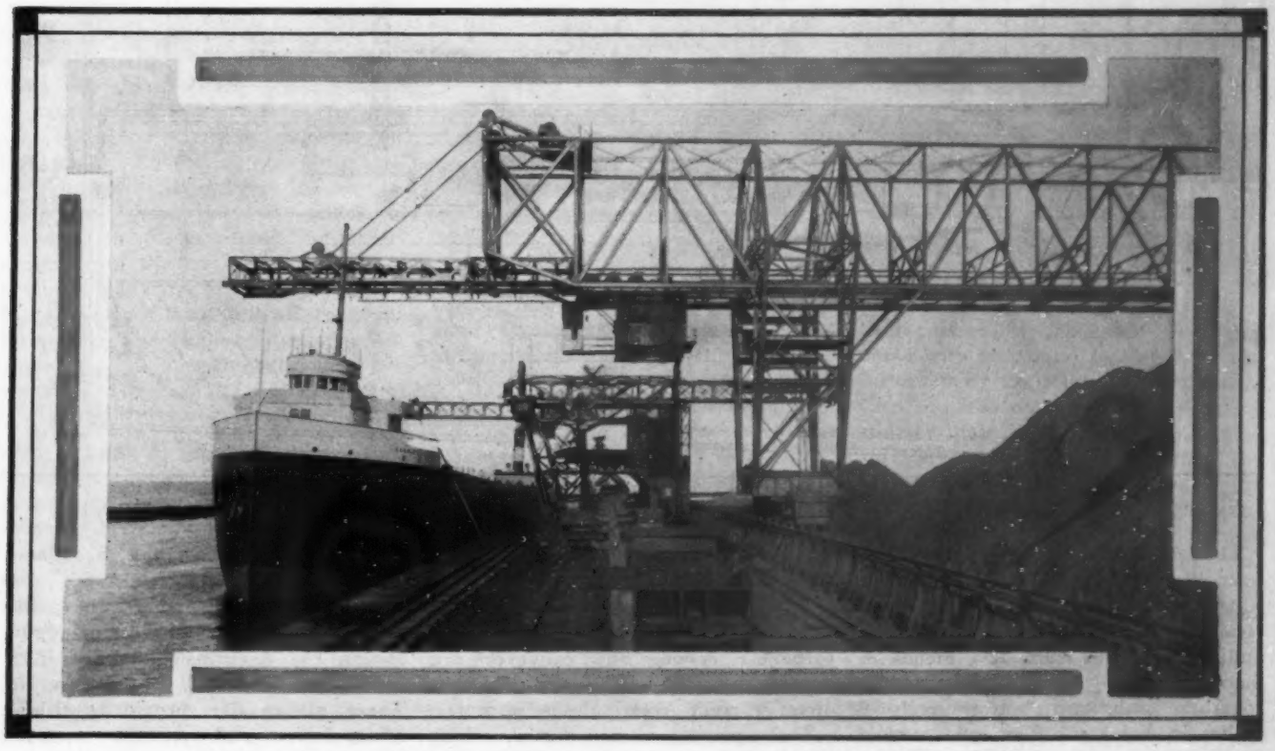


FIG. 12—NEW CONCRETE DOCK WITH ORE AND COAL-HANDLING MACHINERY

revolutions per minute. A 15-ton Alliance crane with a span of 48 feet serves the motor room. The friction load on the motor is approximately 250 kilowatts and the average maximum, when rolling, is about 1,200 kilowatts. The scale from the rolls drops into a pit under the mill, from which it is carried to a central settling basin through a tile drain.

5½-horsepower mill type Westinghouse motor. The runout table from the straightener is 40 feet long and communicates with a 248-foot chain cooling conveyor which delivers the plates to a roller table leading to a 110-inch squaring shear. The cooling conveyor consists of four parallel roller chains driven by sprockets 36¼ inches pitch diameter. The minimum

ing & Foundry Co., is motor-driven. It is 110 inches in width between housings and has sufficient capacity to shear a 1-inch plate. The croppings from the shear drop into a buggy located in a concrete pit underneath. When full, the buggy is hauled out to a point where it can be picked up by the crane and dumped. This is only one of the many minor pieces of labor

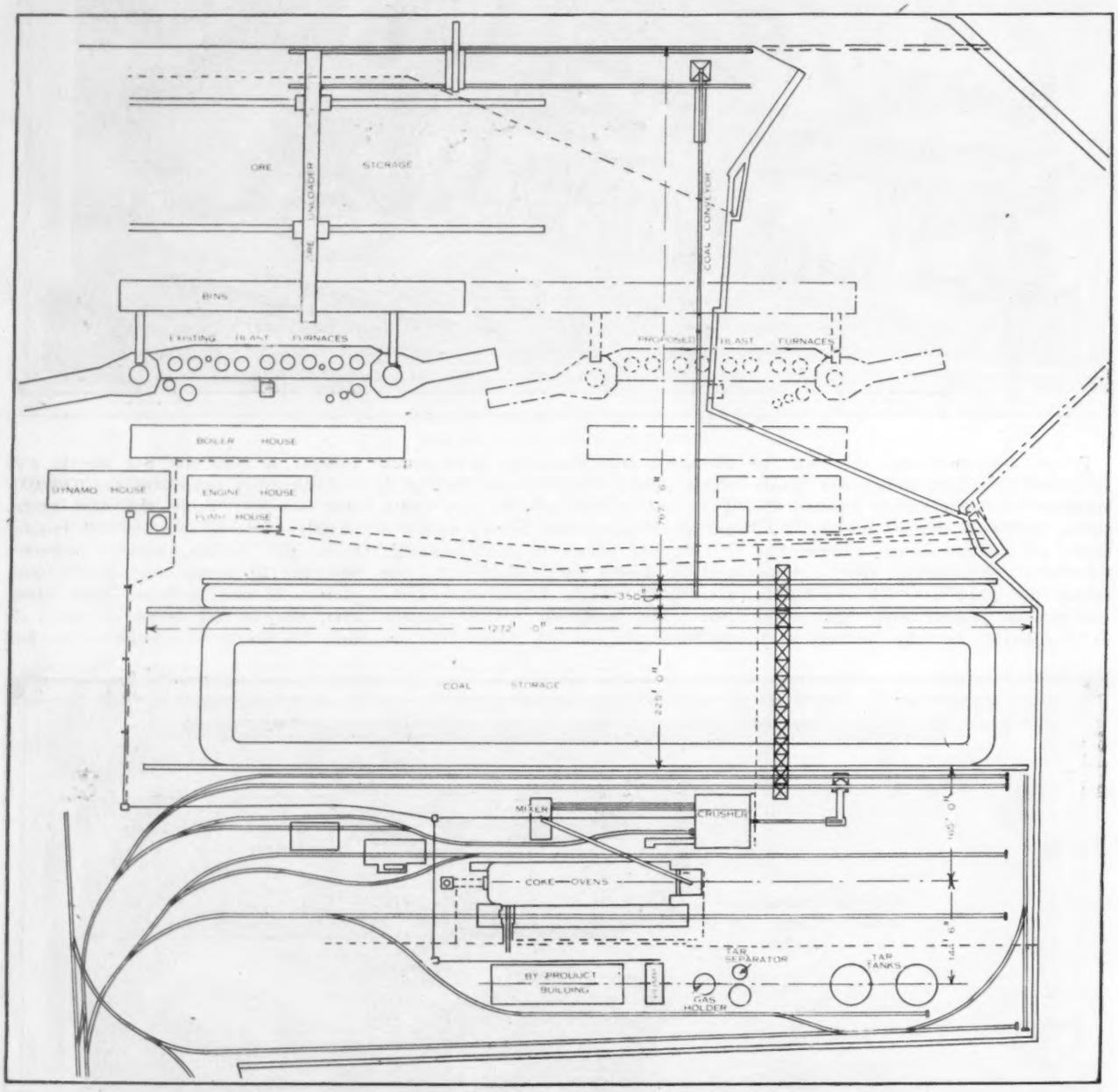


FIG. 13—PLAN OF DOCK, BLAST FURNACES AND COKE OVENS

The finished plates are delivered from the tilting table of the mill to a 50-foot runout table leading to the straightener. The latter has five top and four bottom rolls, 12⅛ inches in diameter and 8 feet, 7 inches long, together with two bottom rolls 9 inches in diameter. The roll speed is 82 feet per minute, the drive being a

speed of the conveyor is 50 feet per minute and about 3½ minutes are required for a plate to travel from the mill to the squaring shear. The sprockets driving the conveyor are geared to a 40-horsepower, 220-volt, direct current Westinghouse motor.

The squaring shear, Fig. 7, which was furnished by the United Engineer-

saving machinery installed throughout the plant.

From the squaring shear, the plates proceed to a pair of rotary edging shears, Fig. 8, furnished by the R. S. Newbold & Son Co., Norristown, Pa. These shears are provided with a motor-driven pull-over for squaring the plate on the approach table to-

gether with a sliding guide, which directs the plate through the shear. Both edges are trimmed at once. The cuttings are removed from the runout table by two laborers, and are trimmed to convenient lengths in small vertical shears and placed in open-hearth charging boxes for remelting.

From the rotary shears, the plates are carried to a turn-over device, Figs. 9 and 10, which delivers them to the casters at the finishing end of the mill. The turn-over device consists of two sets of motor-driven lifting fingers, arranged on two parallel shafts. A 40-horsepower motor drives the device. The plates are inspected on both sides before shipment. A 110-inch splitting shear is installed in the finishing department for trimming plates to small or irregular sizes. This shear, which is motor-driven, was furnished by the United Engineering & Foundry Co., Pittsburgh. It will cut plates up to 1 inch thick and is shown at the right in Fig. 10. A 10-ton magnet crane in the finishing department assists in handling the plates between the caster table and the outgoing cars. The shipping track enters the mill from the north and is depressed, as indicated in Fig. 10.

To provide the additional power necessary for operating the new plate mill without adding to the fuel consumption, a low pressure turbine plant has been built. It contains two Westinghouse units, each rated at 2,500 kilovolt-amperes. These units deliver three-phase, 25-cycle alternating current at 2,300 volts and operate at 1,500 revolutions per minute. They are designed to deliver their full rated capacity on exhaust steam at atmospheric pressure. The steam for the turbines is supplied by the exhausts from the engines driving the blooming mill and 24-inch bar mill. Two Rateau regenerators have been installed to equalize the intermittent output of steam from the engines. They have sufficient capacity to operate the turbines on full load with three-minute intervals. The auxiliary power house equipment includes a Wheeler horizontal condenser, an air compressor and a 20-ton Cleveland crane.

In addition to the new low pressure turbine equipment, two 550-kilowatt generators, direct-connected to cross-compound steam engines, have been installed in the direct current station near the blast furnaces. The units were furnished by the Allis-Chalmers Mfg. Co., Milwaukee.

The coke oven plant is located southeast of the blast furnaces, as indicated in Fig. 13. Sixty-six 13¼-ton Koppers regenerative ovens with a complete by-product recovery plant have been built. The construction work was handled by the H. Koppers Co., Chicago. The coke oven plant has the customary Koppers features, which have been fully described in previous issues of THE IRON TRADE REVIEW. The gas will be utilized in annealing and heating furnaces throughout the plant and also under boilers and in the bolt and rivet departments.

Arrangements have been made to receive all of the coal for the coke oven plant by water during the season of navigation. This will avoid handling coal during the cold winter months and will materially reduce the cost of the coke through the lower freight rates obtainable by water. It has been necessary to provide coal storage facilities sufficient to carry the plant through the season of closed navigation, amounting to about 130 days. The coal storage yard, which is located north of and parallel to the coke ovens, is 1,272 feet in length and 225 feet in width. It has a total capacity of approximately 250,000 tons. A coal-handling bridge of the usual type spans the yard. Two coal-unloading towers have been installed at the dock. Each one has a capacity of 200 tons per hour. They deliver the coal to a belt conveyor, which discharges it under the handling bridge. This conveyor is approximately 750 feet in length with a capacity of 400 tons per hour. The unloading machinery, conveyor and other coal-handling equipment was furnished by the Robins Conveying Belt Co., Chicago.

To handle hot metal conveniently between the blast furnaces and the open-hearth departments and also to provide access to the coke oven plant, a double-track tunnel has been built under the Lake Shore, B. & O., and E. J. & E. tracks, which are located between the blast furnaces and the mills.

As previously mentioned, the improvements to the open-hearth department include four new 60-ton stationary open-hearth furnaces and 36 Hughes 10-foot mechanically poked gas producers to take the place of the oil-burning apparatus employed heretofore. A simple and economical arrangement has been provided to deliver coal to the producers. A gantry crane with a span of 53 feet, 9 inches, furnished by the Alliance Engineering Co., operates over the entire battery and the main hoist carries a 3½-cubic yard grab bucket, which transfers the coal directly from railroad cars to the hoppers over the producers. The details of this arrangement are clearly shown in Fig. 14. The high price of fuel oil has also necessitated a change to coal in the sheet mill, and 18 sheet and pair furnaces have been converted. Sixteen are now coal-fired by American underfeed stokers and two are operated by gas. The scrap handling facilities have been improved by the installation of a new magnet crane

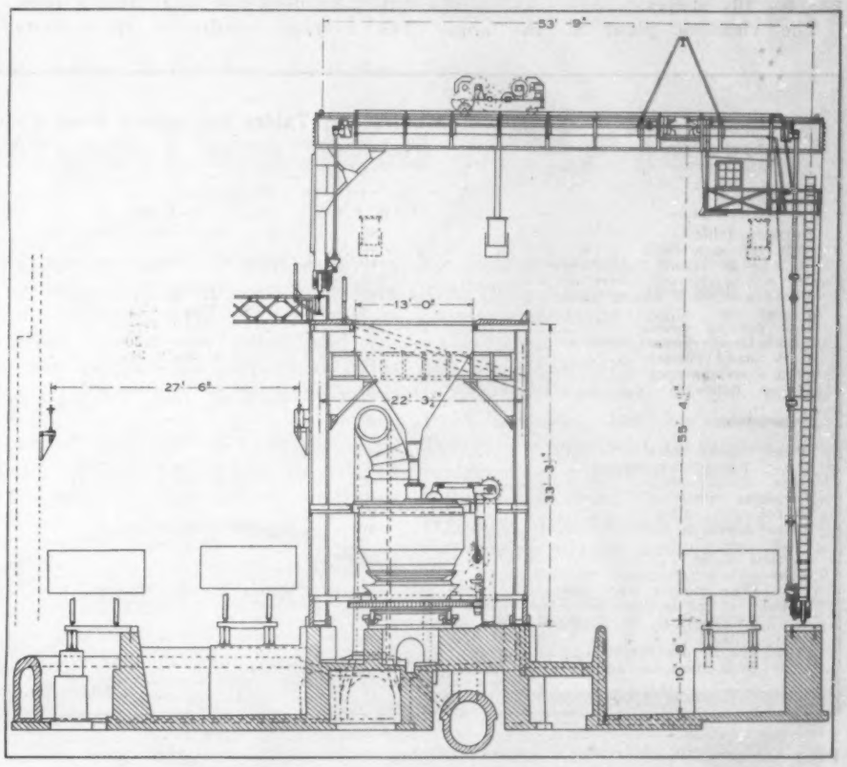


FIG. 14—COAL-HANDLING CRANE OVER THE GAS PRODUCER

and drop ball. The crane has a span of 82 feet and a runway 100 feet long. It is equipped with a 25-ton main hoist.

Gas Cleaning at Pennsylvania Steel Co.'s Furnaces

A valuable contribution to the subject of cleaning blast furnace gas, which is now attracting more attention from operators than at any time heretofore, was made by Samuel K. Varnes, experimental engineer of the Pennsylvania Steel Co., in one of the recent discussions before the American Institute of Mining Engineers. In it he gave the reasons for abandoning the practice of cleaning gas for the stoves.

The cleaning plant at the company's Steelton works consists of a centrifugal dry dust catcher, and two rain type, wet scrubbing towers, 25 x 60 feet each, for rough cleaning blast furnace gas. This plant was installed early in 1910, with the intention of cleaning gas for use in hot blast stoves and under boilers, and was used for several months. Soon after it went into service, the blast furnace men complained that they could not get as high blast temperatures as they had obtained when using dirty gas. It was decided to run a series of careful tests to determine if this were true and to what degree the apparent results might be affected by other conditions. About 60 tests were run covering a period of five months, and at the end the management came to the conclusion that it did not pay to scrub the gas for stoves and boilers. The tests were all run upon a single stove, no boiler tests being made, but the conclusions of the stove tests were applied to the boilers.

Ores Used

The furnace burden was practically the same for all the tests and averaged

	Per cent.
Daquari and other hard ores	57
Nodules	13
Raw Mayari	25
Mill cinder and scale	5

The raw Mayari is exceedingly fine, and produces even more flue dirt than does the fine Mesabi ores. The average results of these tests are shown in the following table:

	Wet scrubbed or clean gas.	Dry cleaned or dirty gas.
Grains of dust per cubic foot	0.3	2-3
Moisture in gas pounds of water per pound of dry gas	0.035	0.05
Temperature of gas at burner	100° F.	300° F.
Temperature of stack gas	450° F.	500° F.
Temperature increase of blast in passing through stove	950° F.	1050° F.

The moisture content of the clean gas it will be noted was only 70 per cent of that of the dirty gas, hence the gas was partially dried by wet cleaning. By the **temperature increase of blast in passing through stove** is meant the difference between the temperature of the blast on leaving and on entering the stove. The dirty gas shows 125 degrees higher blast temperature. The maximum increase of temperature in case of the clean gas was 962 degrees Fahr., or less than the average of the dirty gas.

It was found, further, that the efficiency of the stove and burner as a regenerator was higher by about 1° per cent using dirty gas. The values of these efficiencies are not absolute but relative only, having been determined by the heat balance method after calculating radiation and convection losses from the shell. As higher efficiencies and higher blast temperatures were obtained with dirty gas, and a stove could be kept in service during a furnace run of three years without stopping to clean it, the management saw no reason for continuing to wash gas for stoves, and it was accordingly abandoned early in 1911. The scrubbing plant now is used for preliminary washing for the Theisen final washer on gas engine service.

Details of Motors and Tables for Inland Steel Co.'s Plate Mill[1]

Description.	Motor Data H. P.	Motor Data R. P. M.	Tables Ft. P. M.	Tables Roller Diameter, in.	Tables Roller Length, ft. in.	Tables Roller Bearing, in.
Furnace table	40	$525 \times \frac{18}{80} \times \frac{20}{35} \times \frac{18}{15} = 81$	254	12	3 6	3½ x 8½
Mill approach table	40		254	12	8 0	3½ x 8½
32 x 90-inch mill (screw down)	40	$525 \times \frac{18}{80} \times \frac{20}{35} \times \frac{18}{35} = 81$	...	..	. .	... x ...
*32 x 90-inch mill (drive of)	2,000		...	..	. .	... x ...
Front and back tilting table	(4 ×)40	(Max. 250, Min. 212.5) 245	947	13	4 0¼	3¼ x 7
Tilting rig	..	$525 \times \frac{18}{80} \times \frac{35}{14} = 278.3$	...	..	. .	... x ...
Roll turning device	15	$315 \times \frac{29}{98} \times \frac{21}{75} = 26.1$	...	..	. .	... x ...
Front stand runner table	40	300 — 1,200	254	12	8 0	3½ x 8½
Back stand runner	40	$525 \times \frac{18}{80} \times \frac{24}{35} = 81$	254	12	8 0	3½ x 8½
†Plate straightener	5½	$525 \times \frac{18}{80} \times \frac{24}{35} = 81$	...	..	. .	... x ...
‡Chain conveyor	40	$760 \times \frac{18}{80} \times \frac{14}{93} = 25.74$	100	5	5 0	... x ...
		$525 \times \frac{18}{80} \times \frac{22}{108} \times \frac{24}{115} = 5$	...	..	8 0	... x ...
Shear table	40	$525 \times \frac{18}{80} \times \frac{20}{37} = 64$	267	16	6 4¼	3½ x 8½
			...	10½	5 3	... x ...
Shear runout table	40		254	12	8 0	3½ x 8½
110 x 1-inch plate shear	(2 ×)75	$525 \times \frac{18}{80} \times \frac{24}{35} = 81$	...	..	. .	... x ...
Shear runout table	40	$525 \times \frac{18}{80} \times \frac{24}{35} = 81$	254	12	8 0	3½ x 8½
Turnover device	40	$525 \times \frac{17}{85} \times \frac{16}{72} = 5¼$	...	..	. .	... x ...
50-inch roll lathe	25	250 — 1,000	...	..	. .	... x ...
Shear approach table	40	$525 \times \frac{18}{80} \times \frac{25}{35} = 81$	254	12	8 0	3½ x 8½
§Pull over	7½	$620 \times \frac{14}{88} = 99$	...	..	. .	... x ...
Vertical shear	10		•••	••	. .	... x ...

[1]The motors were furnished by the Westinghouse Electric & Mfg. Co.; the rope drive by the Mesta Machine Co., and the remainder of the equipment by the United Engineering & Foundry Co.

*Mill—Max., 80 R. P. M.; Min., 68 R. P. M.

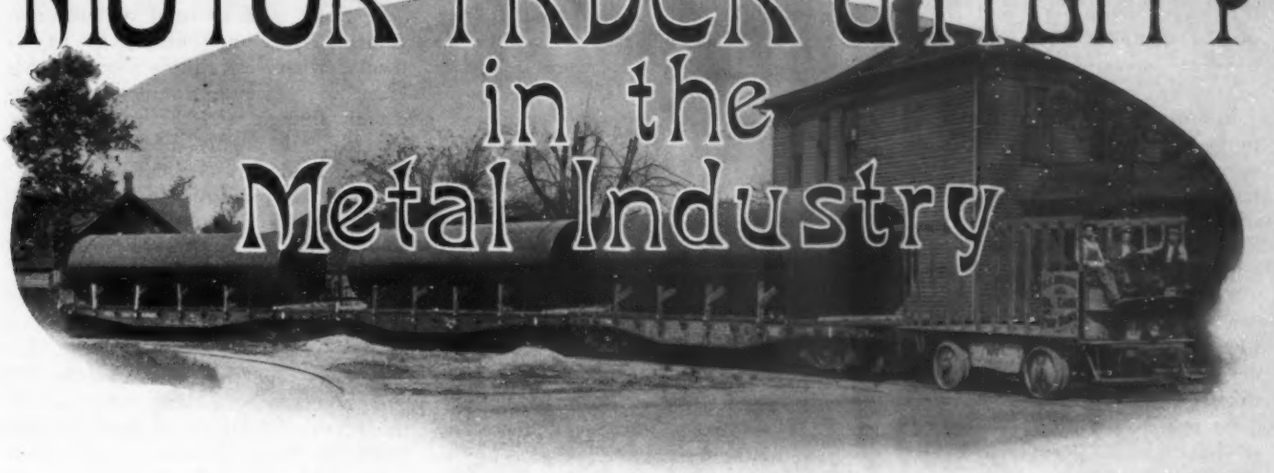
†Speed 82 ft. p. m. 5 top and 4 bottom rolls 12⅛ in. diameter, 8 ft. 7 in. long; 2 bottom rolls 9-in. diameter; 8 ft. 7 in. long.

‡50 ft. per min. speed of conveyor chain.

§4-ft. diameter screw; cross travel speed 16½ ft. per min.

The production of tungsten ore in the United States during 1912 was equivalent to about 1,330 short tons carrying 60 per cent of tungsten trioxide, valued at $502,158. The output for 1912 was larger than that for 1911, when 1,139 tons, valued at $407,985 were produced. The total amount of tungsten produced in the world in 1912 was 9,115 short tons. Tungsten finds considerable use in the manufacture of tungsten incandescent lamps, which have now become common even on street and railway cars, where the usage is especially severe.

MOTOR TRUCK UTILITY in the Metal Industry



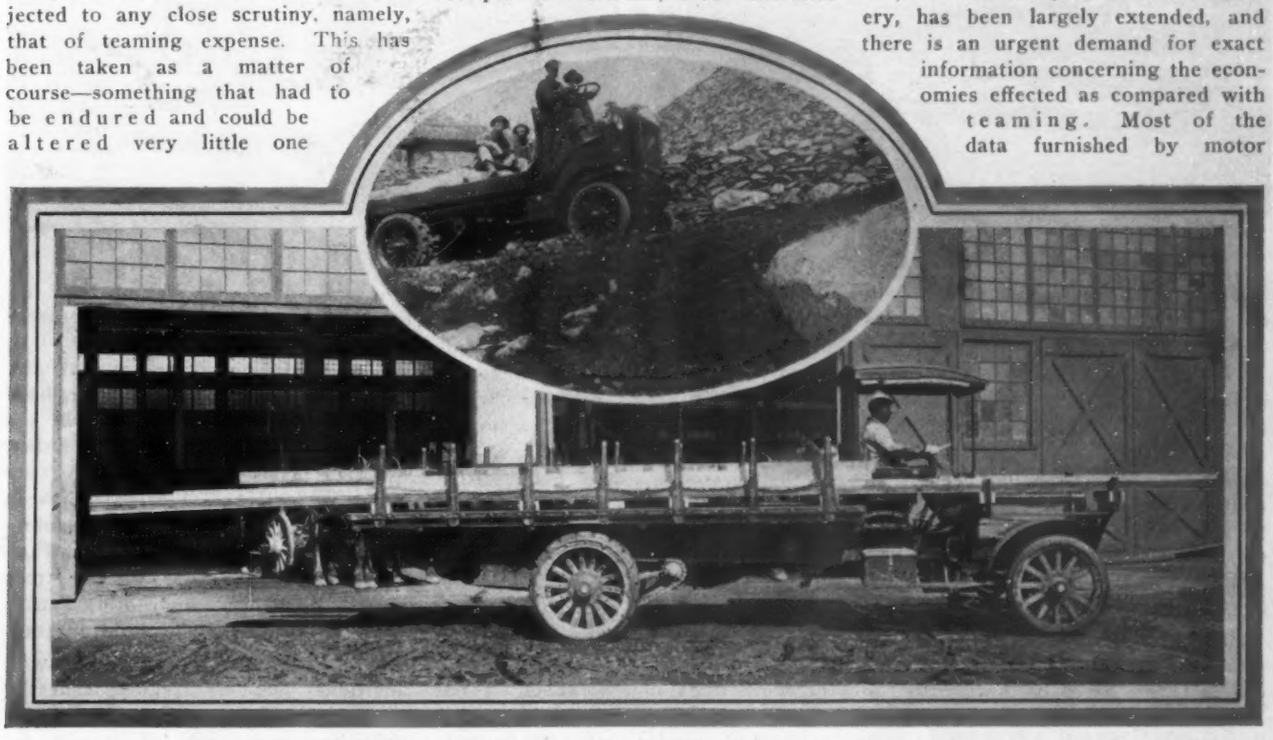
How the Motor Truck Replaces a Switch Engine

Economies Effected Compared With Teams

By C S Rice

IN THE iron, steel and machinery industries considerable effort has been made to keep accurate records of operating costs, with a view to classifying, analyzing and, so far as possible, reducing each of the various elements of expense. This practice has resulted in large economies. One item, however, has seldom been subjected to any close scrutiny, namely, that of teaming expense. This has been taken as a matter of course—something that had to be endured and could be altered very little one way or another. Every plant had one or more teams for local haulage, but just what they cost was seldom figured beyond the price paid for horses, wagons and harness, the bills for feed, shoeing, etc., and the wages of the drivers, which were all lumped together and went to swell the overhead burden. Losses due to delayed receipts of materials, slow deliveries to freight stations, warehouses and customers, or, on the other hand, gains which would result from quicker handling, were phases of the subject not considered.

With the advent of the motor truck all this has been changed. During the past year the use of motor trucks for handling heavy material, such as iron, steel and machinery, has been largely extended, and there is an urgent demand for exact information concerning the economies effected as compared with teaming. Most of the data furnished by motor



THIS STERNBERG MOTOR TRUCK HAS PENETRATED THE IRON ORE COUNTRY AT REPUBLIC, MICH.
THE WAREHOUSE DEPARTMENT OF THE ILLINOIS STEEL CO., CHICAGO, EMPLOYS A PEERLESS MOTOR TRUCK FOR ITS DELIVERIES

truck builders, however, has no bearing upon the industries which this paper represents, and the information compiled represents an independent investigation among users of trucks.

Following are summaries of reports made by concerns representing various branches of the metal industries, covering widely divergent fields of service:

Novo Engine Co.'s Experience

The Novo Engine Co., Lansing, Mich., is using a motor truck for delivering castings from its iron foundry, and loading greatly in excess of the rated capacity—up to 6,500 or 6,800 pounds. The truck also is used to haul gasoline engines, crated, to the various depots and for any other necessary transportation about the plant. "In other words," says the secretary and manager of the company, Clarence E. Bement, "we are using it for a general all-around truck, without any limitations as to its use.

"At the present price of gasoline it is costing us about 85 cents a day to maintain. This includes lubricating oil and any little fixing that we have to do, which has been practically nil.

"We figured that a team cost us an average of $1.50 per day; but the principal saving is not in the difference between the cost of running or maintenance so much as it is the fact that we can do our work in one-half the time, or practically do twice as much work, and even this is not its principal benefit, which is that we are able to deliver goods, for instance, at any station in the city in 20 minutes to one-half hour, whereas with the old team system it meant from one-half hour to two hours. This sometimes enables us to make a shipment when otherwise we could not do so."

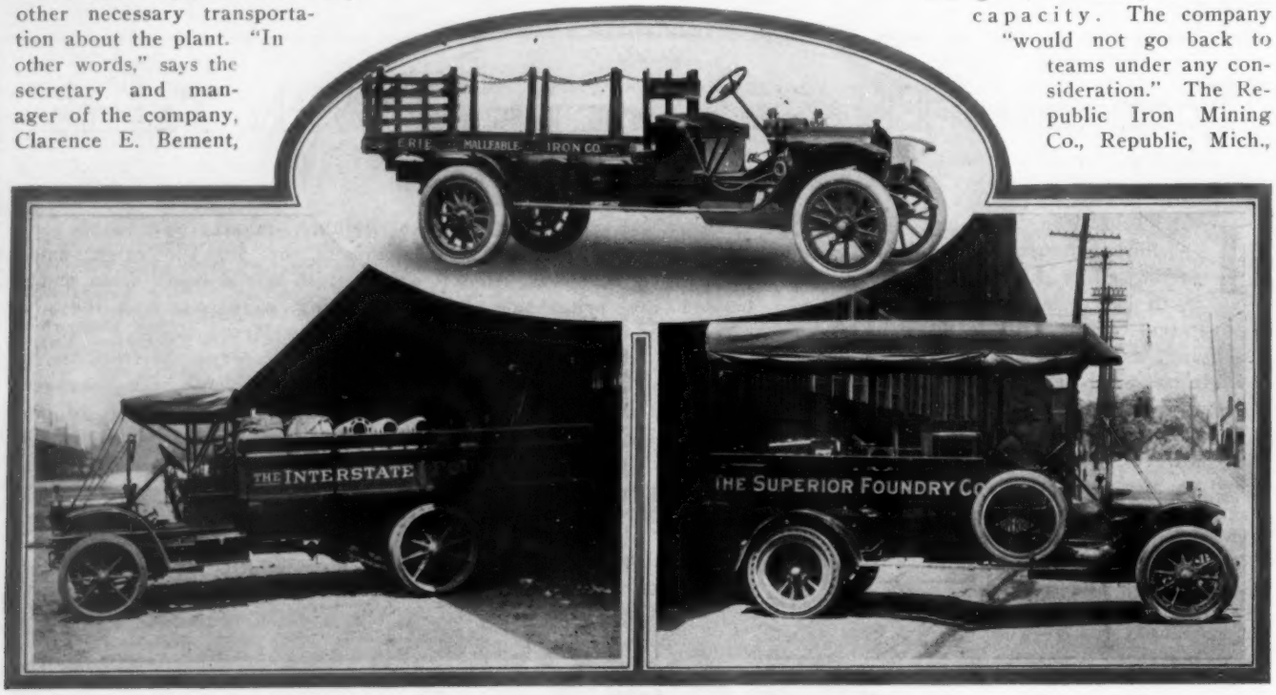
Twice the Work of a Team

The Canada Axe & Harvest Tool Mfg. Co., Ltd., Montreal, Can., had an interesting experience with a motor truck which it tried "as an experiment". Regarding this, the secretary and treasurer of the company, Leslie Drake, says: "Our factory is located in one of the outskirts of the city of Montreal. Our product, consisting of bundles of hay forks and boxes of axes, must be delivered to jobbing houses three miles away, a minimum. Our roads also are far from good. The time spent in loading and unloading could not be affected, but we have found that we can make four trips per day; while, with teams, we seemed to be limited to one trip in the forenoon and one in the afternoon. We believe that the build of the truck itself contributes largely to the saving. We mean that it is compact and can be handled perfectly, under the heaviest traffic conditions. Were this truck as unwieldy as many of the larger trucks, the same saving over the horse might not be effected. The capacity is called 1½ tons with a guaranteed overload of 1,000 pounds. We find, however, that the truck can be loaded away beyond these figures when necessary, although for general practice we figure on two tons. The truck is a thoroughly built machine. The engine has given us no trouble whatever, although our knowledge of gasoline engines was decidedly limited, and the entire vehicle has stood splendidly the rough jolting of our roads.

"In brief, we figure that the truck under our conditions costs 25 per cent more to operate than a team, but does twice the work."

George E. Dean, general manager of the Union Steel Screw Co., Albion, Mich., is authority for the statement that the truck operated by this company is doing what it required two teams to do before. The truck is being loaded, when roads are good, to nearly twice the capacity. The company "would not go back to teams under any consideration." The Republic Iron Mining Co., Republic, Mich., writes as follows: "We have a 2-ton truck in use, but at the present writing are unable to give any conclusive figures as to the saving we are obtaining from the same. It has, however, been substituted for two teams and we believe is doing the work of more than the two teams it displaced. We are using it for general trucking about our surface operations, hauling freight, timber, drills and drilling equipment from shops to and from shafts, explosives and other materials handled by teams and wagons.

"Two men operate the truck, with additional help at irregular times in case of handling heavy materials or unloading car loads of freight received, such as cement, lumber, explosives, etc. We hope to be able to



WHITE TRUCKS USED TO ADVANTAGE BY IRON FOUNDRIES

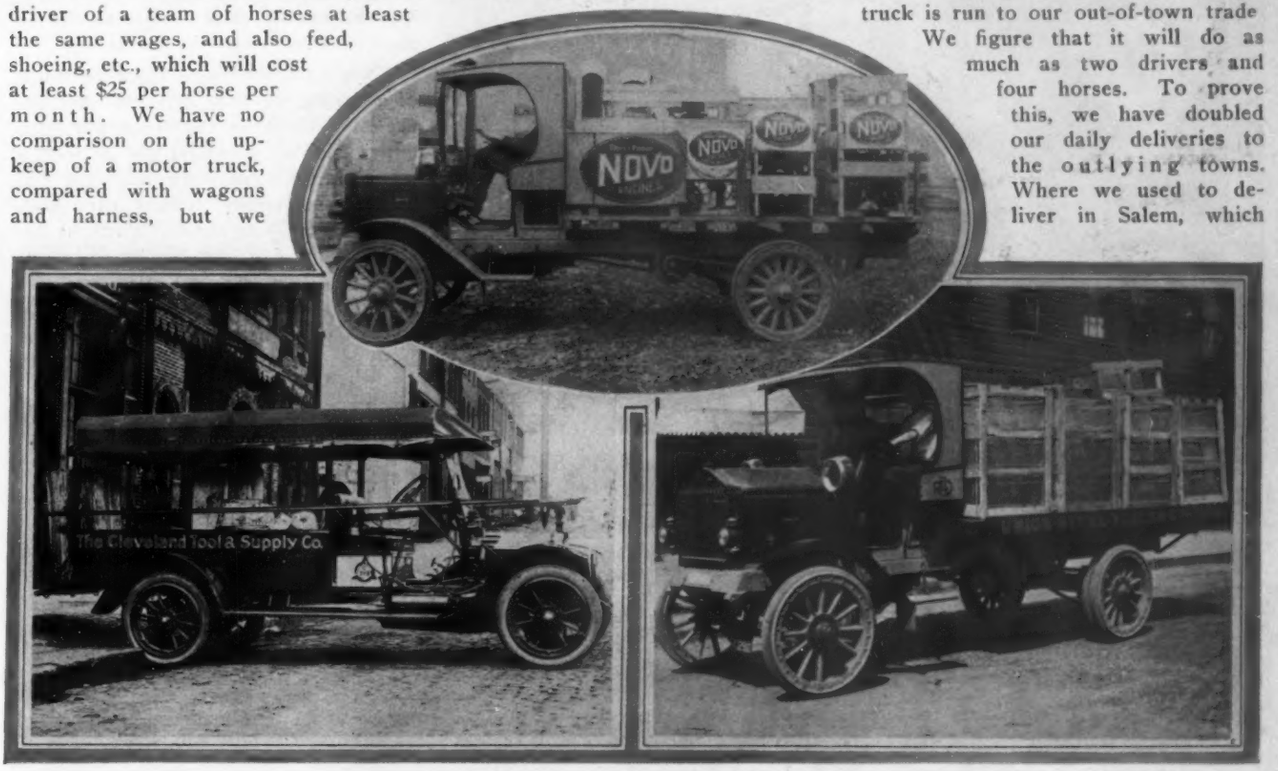
operate the truck through the winter months as well as during the summer."

The Atlas Car & Mfg. Co., Cleveland, is using a motor truck for hauling heavy castings. In respect to the service rendered, the company says: "We figure that we can cover practically the same ground with one truck as we can with two and one-half teams of horses. As the charge for a team of horses is $6 a day, compared with the salary of an auto driver of $15 a week, and about $10 a week for oil and gasoline, you can readily see the saving of a motor truck over a team of horses. You will have to pay a driver of a team of horses at least the same wages, and also feed, shoeing, etc., which will cost at least $25 per horse per month. We have no comparison on the upkeep of a motor truck, compared with wagons and harness, but we have been operating a five-ton truck for two years and outside of the question of tires it has been cheaper for us on the general up-keep of our truck than it was formerly in overhauling our wagons and harnesses."

The Allis-Chalmers Mfg. Co., Milwaukee, has a 3½-ton Kissel Kar truck that has not only displaced three horse-drawn wagons, but a switching locomotive beside. Between the West Allis and Milwaukee plants of this company, a switch engine was in daily use before the Kissel Kar truck was placed in service. The truck now does all the haulage between the two plants, beside city and freight house deliveries.

The Erie Malleable Iron Co., Erie, Pa., has been using a 1½-ton truck, for four years, to transport castings. "During this time," the company reports, "the truck has run practically 20,000 miles, and has been out of service twice, for a period of two weeks each. This was due to the fact that we desired the truck sent to the factory for a thorough overhauling. In no case did we find it necessary to do any work other than a thorough cleaning up of the engine, transmission, repainting of the body, etc., and no replacements were necessary.

"The truck has given perfect satisfaction from the time of its installation and is running today as quietly as a pleasure car."



MOTOR TRUCKS USED FOR HAULING HEAVY PACKAGE FREIGHT

Figures given on the operation of the truck are as follows:

From July 1, 1910, to July 1, 1911:—	
Mileage	5,553.9
Weight carried, pounds	4,391,400
Gallons gasoline used	890
Cost of gasoline	$98.38
Repairs	78.69
Incidental expenses	312.99
From July 1, 1911, to July 1, 1912:—	
Mileage	6,671.4
Weight carried, pounds	3,123,520
Gallons gasoline used	916
Cost of gasoline	$99.25
Repairs	30.45
Incidental expenses	456.31
From July 1, 1912, to July 1, 1913:—	
Mileage	6,482
Weight carried, pounds	4,483,535
Gallons gasoline used	1,085
Cost of gasoline	$160.58
Repairs	15.25
Incidental expenses	418.23
Driver's wages	780.00

This truck is equipped with pneumatic tires—dual in the rear—and the main item under "incidental expenses" is the replacement of tires. Also, under the same heading are included garage supplies, while under "repairs" come all of the time placed on the truck, either by the plant's own mechanics or those outside. The average length of haul is 1½ miles, and the average load carried is 2,700 pounds.

Heavy Hardware Trucks

The Collins Hardware Co., Lynn, Mass., uses trucks extensively for deliveries. Concerning this the management states: "We handle heavy merchandise, such as nails, bar iron, fertilizers and general hardware. This truck is run to our out-of-town trade We figure that it will do as much as two drivers and four horses. To prove this, we have doubled our daily deliveries to the outlying towns. Where we used to deliver in Salem, which is five miles from Lynn, once a week, to Marblehead, which is six miles from Lynn, once a week, and to Lynnfield, Cliftondale and Saugus, which are on an area of five or six miles, once a week, we now do the same thing with one truck and one man, and make two deliveries a week.

"We have five trucks:
1—5-ton White, 1913.
1—3-ton Dayton, 1913.
1—2-ton Reo, 1913.
1—¾-ton White, 1913.
1—1-ton Franklin, 1910.

"We have had very good service with all our trucks, but we have them looked after and cared for every night by a thorough mechanic, and the trucks are always greased, oiled, watered and filled with gasoline, ready

to start at 7 o'clock in the morning."

The Scully Steel & Iron Co., Chicago, has a 5-ton truck on which it handles all of its regular lines of iron and steel. H. J. Lord, of the operating department, figures that this truck takes the place of three teams.

The May-Fiebeger Co., Akron, O., manufacturer of heating furnaces, states that its motor truck is hauling loads for which three teams were formerly necessary. The expense is not much more than for one team; and, beside eliminating the services at $1,700. This covers salaries, repairs, insurance, fuel, oil and grease.

The Pittsburgh Malleable Iron Co., Pittsburgh, says, in a letter written by Superintendent John B. Coates: "We have two 5-ton electric trucks which we have had in service for about four years. These trucks have given us very satisfactory service, and we carry almost anything on them that can be hauled. We haul sand, coal, pig iron, castings and all other materials that are required by a foundry. Regarding the saving, we have not estimated that, but it is not costing us over what it costs us for team hire, and we have much better results in not being bothered with the troubles accompanying the handling of teams."

ELECTRIC TRUCK USED BY THE PITTSBURGH MALLEABLE IRON CO.

of the two extra drivers, less men are needed for handling the material.

J. R. Bowles, who is a large dealer in steel rails, at Portland, Ore., had an experience with motor trucking which he describes as "most unsatisfactory." He disposed of the machine at a sacrifice.

The Cleveland Tool & Supply Co., Cleveland, estimates that its truck, carrying loads that average 1,500 pounds, will do about two and one-half times the work of an ordinary horse and wagon. Secretary W. W. Kelley states that the company would not consider going back to the old plan of deliveries.

Truck for Steel Jobbers

The Betz-Pierce Co., Cleveland, has a truck which was built to carry steel products, such as bars, shapes, plates and sheets. Its capacity is five tons. For a period of nine months the truck has carried material that, if hauled by team, would have cost $3,450. The expense, including interest on investment at 6 per cent, but not allowing for depreciation, is figured

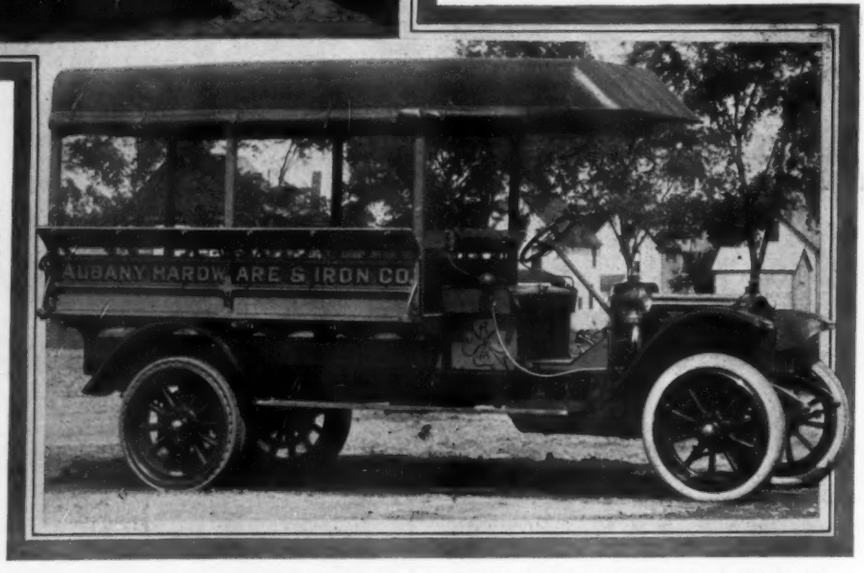
The Hunt-Spiller Mfg. Corporation, Boston, which operates a large foundry, has two motor trucks, which are used for hauling sand, coal, coke, pig iron and castings. Concerning its experiences the company says: "The trucks are of two types,—one being four-wheel drive and the other two-wheel drive. The usual load we carry on these trucks is five tons, and in addition to this, we at times attach a trailer carrying five tons, to the four-wheel drive truck.

Used for Switching

"We have not had the trucks long enough to know the exact rate of depreciation, so we do not know the actual cost of operating, but we estimate that it is about the same as hauling with horses."

L. C. Steger, purchasing agent for S. F. Bowser & Co., Ft. Wayne, Ind., writes an interesting letter concerning the use of their motor trucks, in the course of which he states:

"It is hard for us to say how much of a saving we have effected over the use of a team, as the truck performs duties such as we could not do with a team; for instance, we shift all our loaded and empty freight cars both to and from our siding, which is located about five city blocks from our factory. You can see that we are very well pleased with the performance of the first truck, for just as soon as our business increased to such an extent that it could not be taken care of by one truck, we immediately ordered another one of the same type."



WHITE, 1½-TON TRUCK USED BY THE ALBANY HARDWARE & IRON CO.

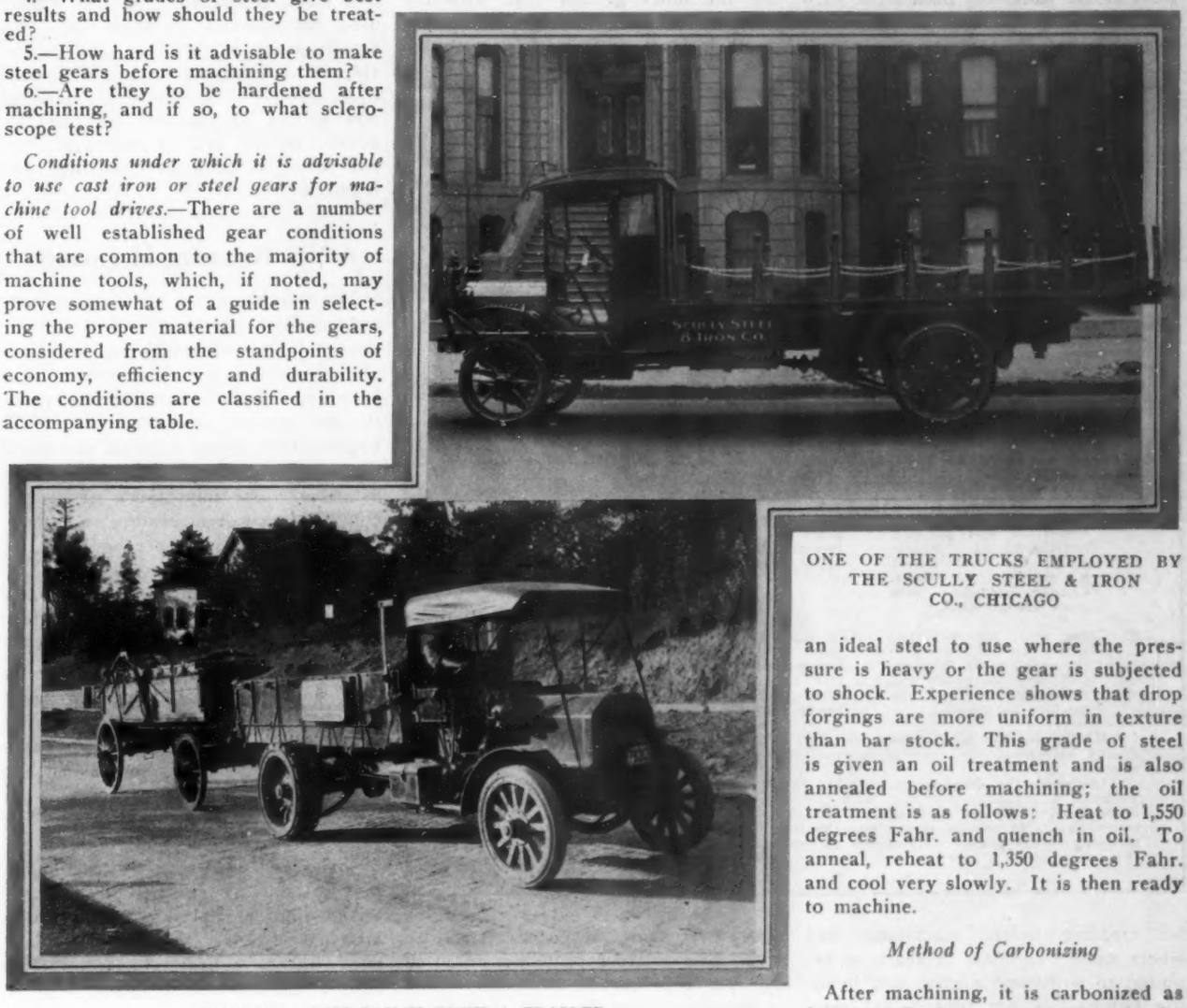
The H. W. Johns-Manville Co., New York City, was awarded the contract for covering all of the pipes in New York City's Municipal building. Twenty-seven carloads of pipe covering were required for covering the steam, hot water, ventilating, cold water and ice water lines.

Gears for Machine Tool Drives

The following six questions relating to the use of gears for driving machine tools were discussed by John Parker, of Providence, R. I., before the American Society of Mechanical Engineers:

1.—Under what conditions is it advisable to use cast iron or steel gears for machine tool drives?
2.—Are the objections to cast iron on the ground of wear or breakage?
3.—What tooth pressure is safe for cast iron gears?
4.—What grades of steel give best results and how should they be treated?
5.—How hard is it advisable to make steel gears before machining them?
6.—Are they to be hardened after machining, and if so, to what scleroscope test?

Conditions under which it is advisable to use cast iron or steel gears for machine tool drives.—There are a number of well established gear conditions that are common to the majority of machine tools, which, if noted, may prove somewhat of a guide in selecting the proper material for the gears, considered from the standpoints of economy, efficiency and durability. The conditions are classified in the accompanying table.



PEERLESS 5-TON TRUCK WITH A TRAILER

ONE OF THE TRUCKS EMPLOYED BY THE SCULLY STEEL & IRON CO., CHICAGO

The objections to cast iron.—The objections to cast iron cover both wear and breakage. If the speed is excessive, say above 500 feet per minute, they are likely to wear quite rapidly; and on slow speeds and heavy pressure breakage will occur, unless they can be made of adequate size, as in the case *E*, indicated in the accompanying table, where the back gears are so located in the machine that it is possible to employ large diameters, coarse pitches, and wide faces.

The safe tooth pressure for cast iron gears.—The question of tooth pressures in cast iron gears is somewhat problematical. The Brown & Sharpe Mfg. Co. has in successful operation a gear in the spindle drive of its largest milling machine, made from a hard, close-grained cast iron having a tensile strength of 23,000 pounds per square inch, which when running at the slowest speed sustains a pressure on the teeth of 8,250 pounds. It is calculated that two teeth are always in contact, which gives 4,125 pounds pressure per tooth. The area in cross-section of each tooth is 1¼ square inches, equaling 3,300 pounds per square inch; when the gear runs at the fastest speed, the pressure is about 1,000 pounds per square inch. It is not known whether the pressure could be increased to any considerable extent, but it has been overloaded to at least 30 per cent without injuring it; this was when testing out the machine and the overload was of short duration. It might be said that this gear is not subjected to any sudden shock; if it were, the allowable tooth pressure would be considerably less.

The grades of steel that have given best results and how they have been treated.—For gears that are of small proportions and yet are subjected to heavy duty, it has been found that in cases where the more common steels have failed, excellent results have been obtained from using a 5 per cent nickel steel. This steel case-hardens with a very hard surface and still has a strong and tough core, making it an ideal steel to use where the pressure is heavy or the gear is subjected to shock. Experience shows that drop forgings are more uniform in texture than bar stock. This grade of steel is given an oil treatment and is also annealed before machining; the oil treatment is as follows: Heat to 1,550 degrees Fahr. and quench in oil. To anneal, reheat to 1,350 degrees Fahr. and cool very slowly. It is then ready to machine.

Method of Carbonizing

After machining, it is carbonized as follows: Pack in any good carbonizing material and cover carefully to exclude air; place in furnace and heat to 1,700 degrees Fahr., and hold long enough to get the desired depth of casing. Care should be taken to have it heated entirely through. Ordinarily three or four hours will suffice for this process. Then take out of furnace and cool off in the boxes; remove from the boxes and place in furnace or bath; reheat to 1,550 degrees Fahr. and quench in oil. Again reheat to about 1,380 degrees Fahr. and quench in oil or water, according to the size

and shape of the gear. If the gear is of generous dimensions and free from sharp corners, water is preferably used. Small, slender gears are quenched in oil, on account of the liability of cracking if water is used. For ordinary gears the scleroscope test should show 80 to 85 points of hardness. If the gears are used as clash gears, they should be drawn to 475 degrees Fahr., or about 70 to 75 points of hardness, by scleroscope test, to avoid chipping.

Degree of hardness advisable for steel gears before machining them.—The various kinds of steels used for gears are of such a nature that they do not call for treating before machining, but where extra toughness in shafts is required to withstand torsion and bending strains, 3½ per cent nickel steel is satisfactory. This grade of steel is rough-machined, then heat-treated, as follows: Place in open furnace or bath, heat to 1,500 degrees Fahr., and quench in oil. It is advisable to experiment with a small quantity in each batch before subjecting a whole lot to the drawing-out heat, which should commence at about 700 degrees Fahr. If the scleroscope registers between 50 and 58, the correct hardness has been obtained; if higher than 58, the parts should be reheated to a higher temperature than before; if lower than 50, the parts must be rehardened. After this treatment, the pieces are finish-machined. No further hardening is necessary. When machining, slow speeds and feeds must be used.

Hardening after machining, and the scleroscope test.—Practically all alloy steels and all low-carbon steels are hardened after machining and finished by grinding after hardening. About 0.010 inch on the diameter is left for this operation. All gears should run true, and to obtain this result not only are the holes ground true with the pitch circle, but the hubs are ground on their faces so they will set square with their shafts when tightened by nuts. The scleroscope test for 0.30 to 0.35 per cent carbon machinery steel is anywhere from 80 to 90, and for 5 per cent nickel steel for ordinary gears 80 to 85, and for clash gears, 70 to 75. All steels are tested by the file in addition to the scleroscope. The file test by an expert is reliable and some feel that possibly more confidence can be placed on his judgment than on any testing instrument.

GEAR CONDITIONS COMMON IN MACHINE TOOLS.

			Material.
A	Gears always in mesh, the wear on the teeth being constant.	(a) Slow speeds, light duty. (b) Slow speeds, heavy duty. (c) Fast speeds, light duty. (d) Fast speeds, heavy duty.	Cast iron. Machinery steel. Machinery steel. Machinery steel, case-hardened.
B	Gears in sets that are removable and interchangeable with each other, distributing the wear over a number of gears.	These are change gears used in thread cutting on lathes, spiral cutting on milling machines, indexing on automatic gear cutters and feed and speed change gears; speeds and pressures are generally moderate.	Cast iron, excepting the smallest, which may require to be of steel.
C	Gears in sets that are nonremovable and partially interchangeable, distributing the wear over a number of gears. Changes made while gears are in motion.[1]	Used as quick-change feed gears — changes made by levers; speeds and pressures moderate.	Machinery steel, case-hardened.
D	Gears in sets that are nonremovable and partially interchangeable, distributing the wear over a number of gears. Changes made when gears are at rest.[2]	Used as quick-change speed gears — changes made by levers; high speeds and heavy pressure.	Machinery steel, case-hardened.
E	Gears that are employed only part of the time the machine is working, and are engaged and disengaged when the machine is stopped.	This condition applies to back gears for the spindle drive. Gears are made large diameter, coarse pitch and wide face; speeds moderate and heavy pressure.	Hard, close-grained cast iron.

[1]If the changes were made when the machine was at rest, the gears would not require hardening. But custom demands that changes be made while the machine is running.

[2]Although the changes are supposed to be made when gears are at rest, careless workmen will violate this rule, with the possibility of breaking the engaging gears. Some makers use an alloy steel in their spindle train to prevent breakage, but a better way is to provide means whereby it is necessary to stop the machine before throwing in the gears. This applies to the tumbler type of change gearing.

Worm and Worm Wheel Drive

The above notes apply to spur and bevel gears. For worm and worm wheel drives, the worm should be made of machinery steel, case-hardened, and the wheel of a hard bronze. Both should run in a bath of oil, especially if under high speed and heavy duty. Spiral gears should be used only where the duty is light. The material should be the same as for a worm and wheel, and they should also run in oil to avoid cutting.

For index mechanisms, where accuracy is essential, if the worm is hardened the thread must be ground afterwards. This is done in all the spiral heads of Brown & Sharpe's make. Generally, the worm, made of tool steel, is left soft. Worm wheels used for indexing purposes only are usually made of cast iron, and invariably if of large diameter. High-multiple threaded worms for indexing mechanisms should not be used; a double thread can be tolerated, but not more, if accurate indexings are required.

A New Recording Hygrometer

The advantages of obtaining a record of both the dry and wet bulb temperatures independently, but simultaneously on the same chart, have been appreciated by engineers, but up to the present time recording hair hygrometers giving a single record of the relative humidity only have been available. The importance of proper conditions of temperature and humidity is being appreciated to a greater extent than in the past as they have a bearing on health and human efficiency and have an effect upon many products during the process of manufacture.

To meet the demands for a wet and dry bulb recording hygrometer the Industrial Instrument Co., Foxboro, Mass., has designed an instrument which consists of two sensitive bulbs mounted in tandem back of the instrument case, the wet bulb being jacketed and kept moist by maintaining water at a constant level in a trough underneath. The pen arms are attached directly to shafts concentric with the helical tube bulbs. The case is mounted on a swivel bracket which permits swinging the instrument at right angles to the wall or support, giving easy access to the water glass bottle serving as a water reservoir. This instrument is made in three sizes to cover ranges between the freezing and boiling points of water.

A circular recently issued by the Newton Machine Tool Works, Inc., Philadelphia, illustrates and describes briefly several of the cold metal sawing machines built by this company.

THE IRON TRAD

CHARTS SHOWING FLUCTUATIONS IN IRON AN

Chart Showing Fluctuations in Iron and Steel P

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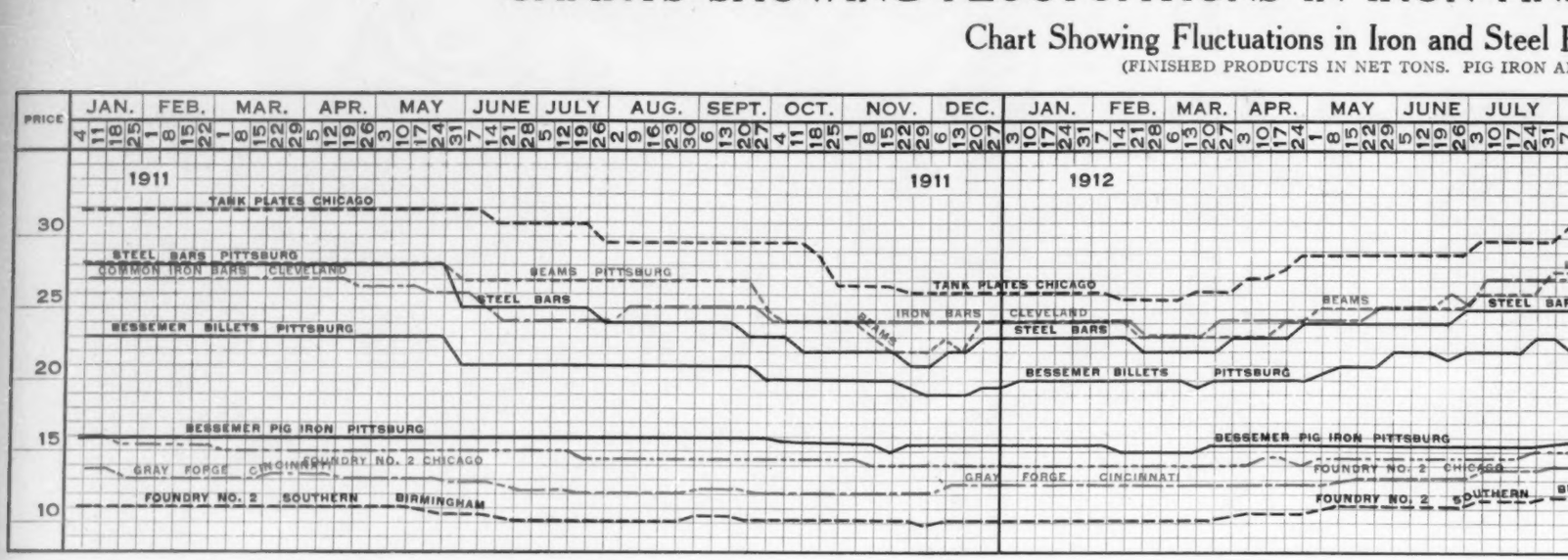

Fluctuations in Iron and Steel Prices for Sixteen Y

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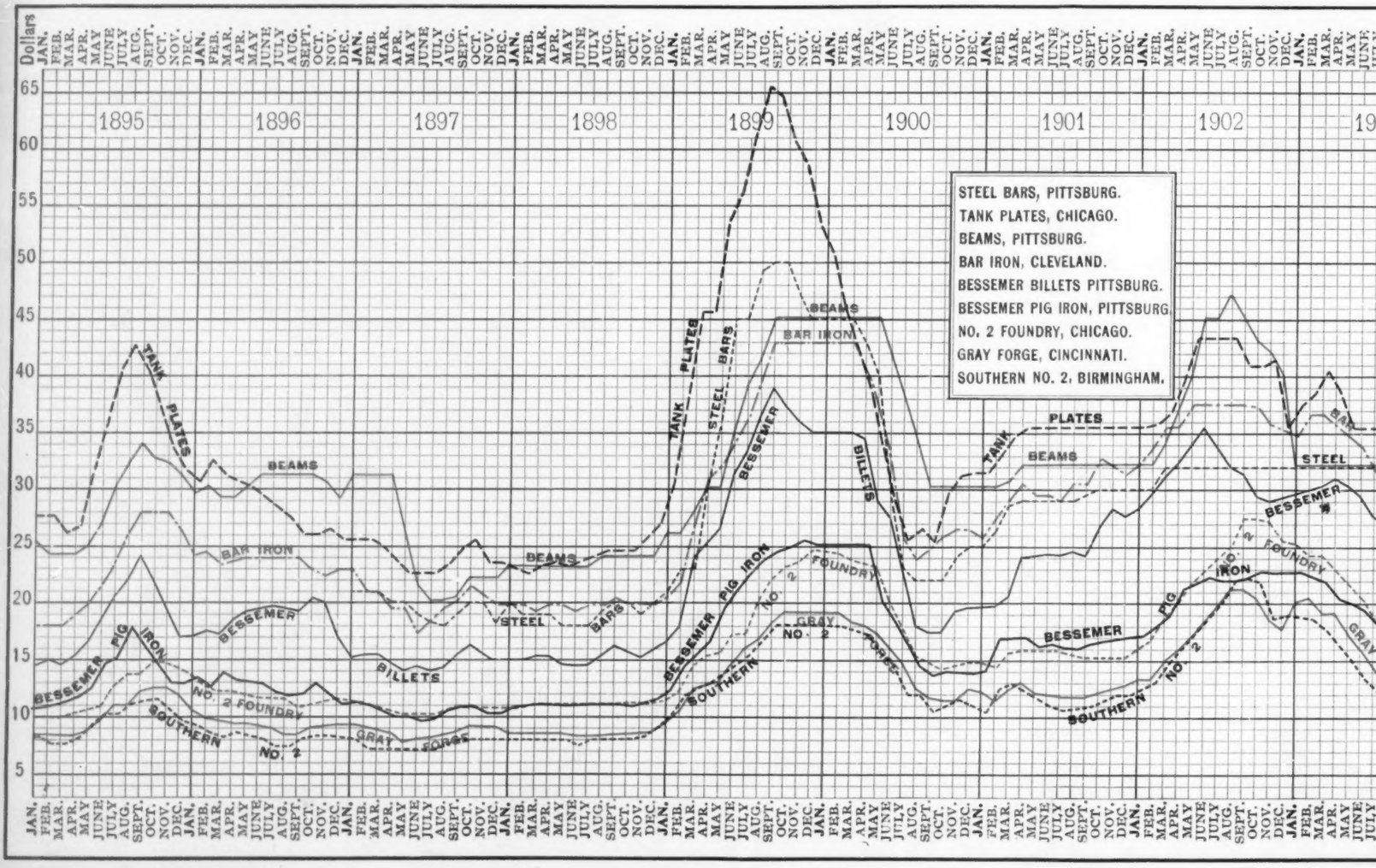
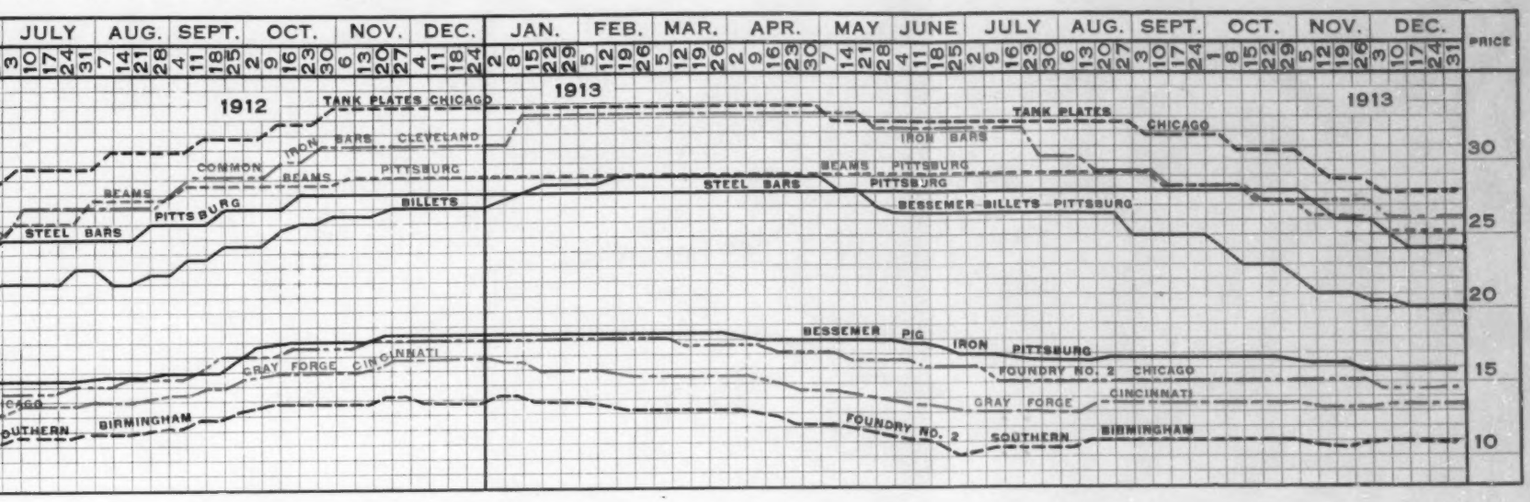


ADE REVIEW

N AND STEEL PRICES FOR NINETEEN YEARS

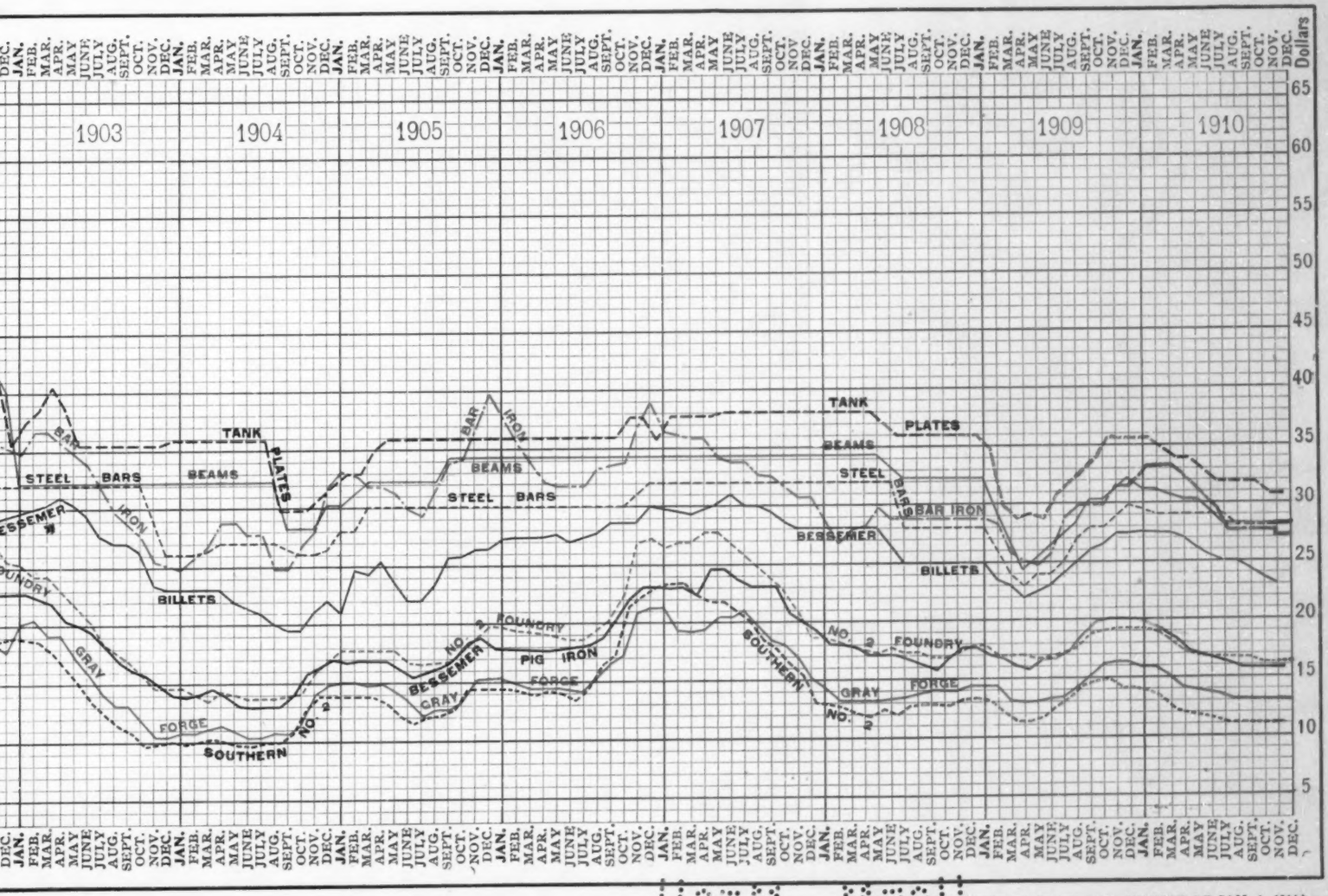
d Steel Prices in 1911-12-13 By Weeks

PIG IRON AND BILLETS IN GROSS TONS.)



Sixteen Years—1895 to 1910—By months

PIG IRON AND BILLETS IN GROSS TONS.)



(TABLES OF PRICES ON WHICH THESE CHARTS ARE BASED ARE PUBLISHED IN THE IRON TRADE REVIEW OF JAN. 1, 1914.)

How Steel Can Be Heat-Treated Economically

Accuracy of Temperature Can Be Insured by Measuring Instruments With Remote Control — The Use of Electric Furnaces

By E F Lake

COMPARATIVELY few manufacturing plants give proper consideration to the heat-treatment of their steel. In many cases the waste in fuel runs into large figures in the course of a year, while accuracy in the annealing, hardening, tempering, or carbonizing of the steel is ignored. The old method of heating the metal in coal or coke fires and guessing at the degree of temperature by the color of the steel, has been discarded in many shops, although it is still practiced in a number of plants. Furnaces that confine the heat within their walls, and use gas, oil or powdered coal for fuel, have replaced the forge fires in a great majority of the shops, but these are often of poor design, and hence are more wasteful of fuel than they should be. In this case it is impossible to maintain a uniform, accurate temperature in all parts of the heating chamber, or in any given part during the length of time that is required for heating the metal. Inaccurate and non-uniform work results and often losses are incurred by the failure of such parts.

The static strengths, wearing qualities, and resistance to fatigue, or the life of the steel, can be increased greatly by heat-treating it accurately at the correct temperatures. Incorrect heat-treatment, however, destroys the inherent physical properties of steel to a greater or less extent, according to the amount of variation from the correct temperature.

An annealing temperature that is too low consumes more time to heat the metal than the correct temperature, and thus more fuel is used than when the temperature is correct. The metal also is liable to be left harder than the lowest degree of softness it is capable of assuming, and hence it costs more for machining operations or other work to which the parts may be subjected. When the annealing temperature is too high the grain of the metal is liable to become coarse and this weakens and lowers the physical properties. The lowest degree of softness may not be obtained with this high temperature and the same difficulties may arise as from the application of a low temperature. A correct tempera-

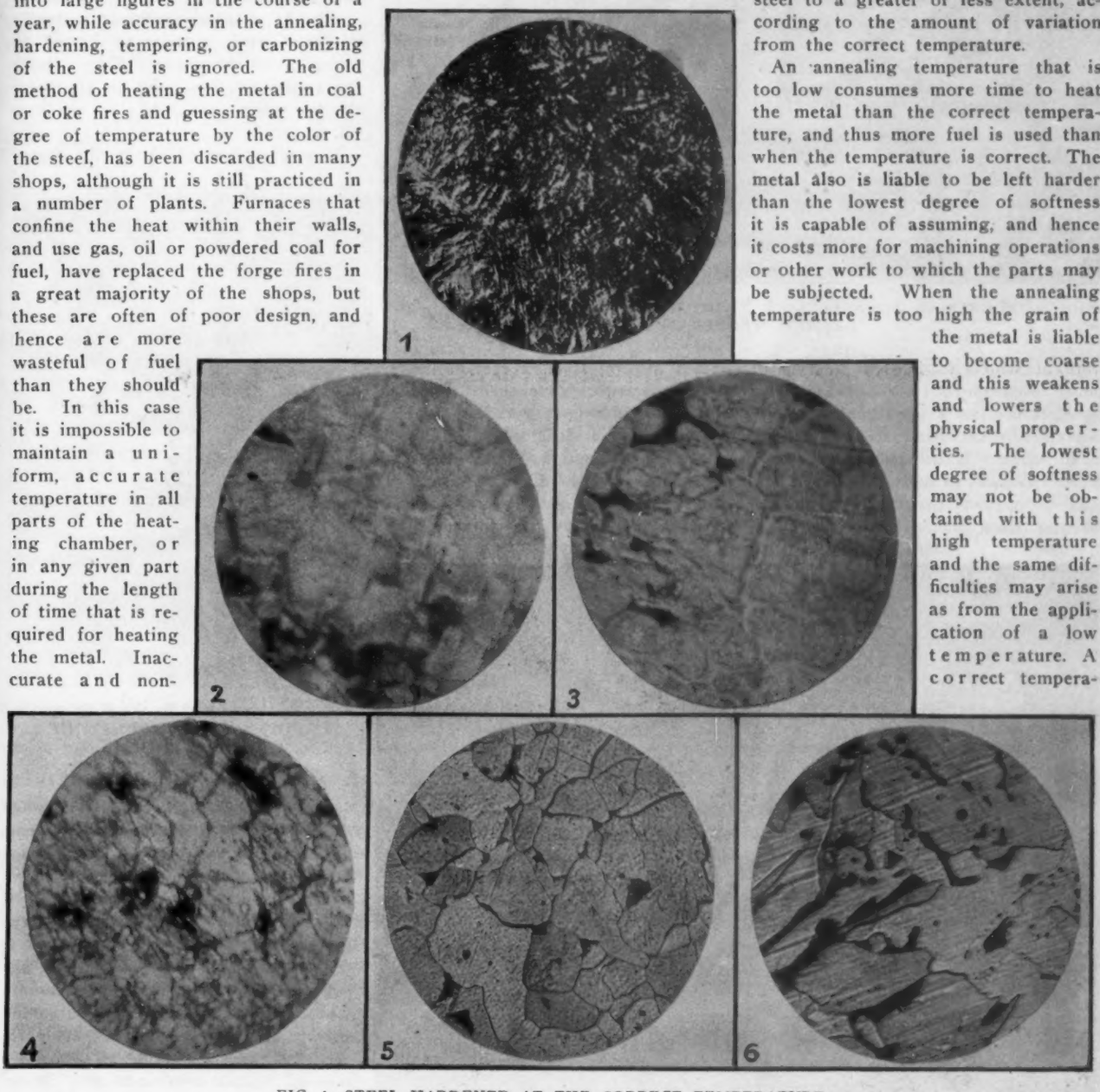


FIG. 1—STEEL HARDENED AT THE CORRECT TEMPERATURE

FIG. 2—STEEL QUENCHED AT 50 DEGREES ABOVE TRANSFORMATION POINT

FIG. 3—STEEL QUENCHED AT 100 DEGREES ABOVE TRANSFORMATION POINT

FIG. 4—STEEL QUENCHED AT 200 DEGREES ABOVE TRANSFORMATION POINT

FIG. 5 — QUENCHED 300 DEGREES ABOVE TRANSFORMATION POINT, CRYSTALLIZATION STARTED

FIG. 6 — QUENCHED 400 DEGREES ABOVE TRANSFORMATION POINT, CRYSTALLIZED BY OVERHEATING

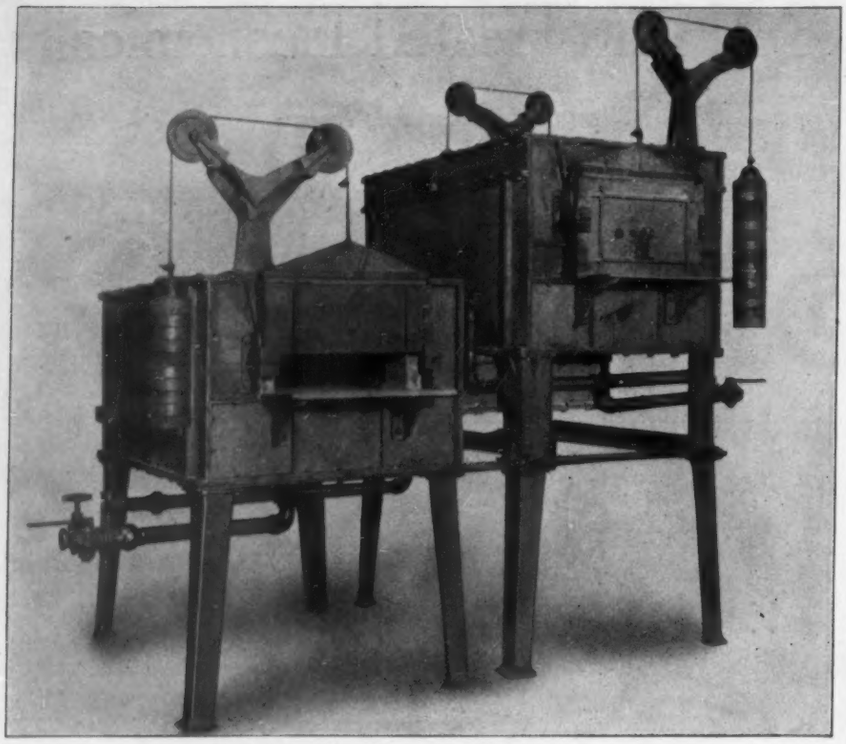


FIG. 7—INDUSTRIAL FURNACE CO.'S TWIN FURNACE FOR HARDENING AND DRAWING TEMPERATURES

ture at which to harden steel is of more importance than the annealing temperature, as a variation here makes a great difference in the strength and life of the metal. If the hardening temperature is too low, steel cannot be hardened and its physical properties will be no greater than that of untreated steel. When heating steel, a certain degree of temperature is reached at which the grain undergoes a radical change, or a new grain structure is developed. This transformation point varies in temperature with different kinds of steel and should be known before attempting to harden the metal. If not heated to this point, the change in grain structure will not take place and the steel will not harden.

If heated to this point and held at that temperature long enough for the transformation to take place the grain of the steel will be as fine and dense as it can be made. If instantly cooled from this temperature to that of the atmosphere this fine grain will be retained and the metal will be given the highest degree of strength it is capable of assuming. It will be extremely brittle, however, and must again be heated sufficiently to give it the degree of toughness that is desired. As it is impossible to instantly cool the steel, it must be heated to from 25 to 40 degrees Fahr. above the transformation point to allow for the lag when quenching the metal in oil, water, brine, etc.

If steel is heated above the transformation point more than 25 to 40 degrees, the grain gradually becomes coarse with each degree that its temperature is raised. As the grain grows coarser, the metal gradually looses its inherent strength. When the temperature is raised 50 degrees too high and the steel is quenched, the fatigue test will show a 15 per cent loss in the number of alternate vibrations the specimen will withstand before breakage occurs. A temperature 100 degrees too high shows a loss of 29 per cent and one 150 degrees too high shows a loss of 43 per cent. This test reflects the length of life of a steel part under working conditions and well illustrates the bad reputation and losses that a company may incur from inaccuracy in the har-

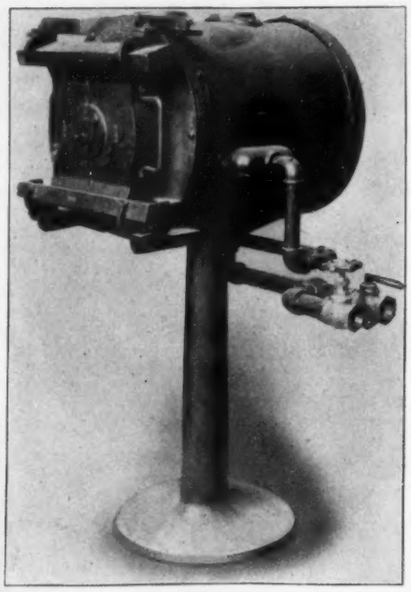


FIG. 9 — CYLINDRICAL HARDENING FURNACE FOR TOOLS AND SMALL WORK

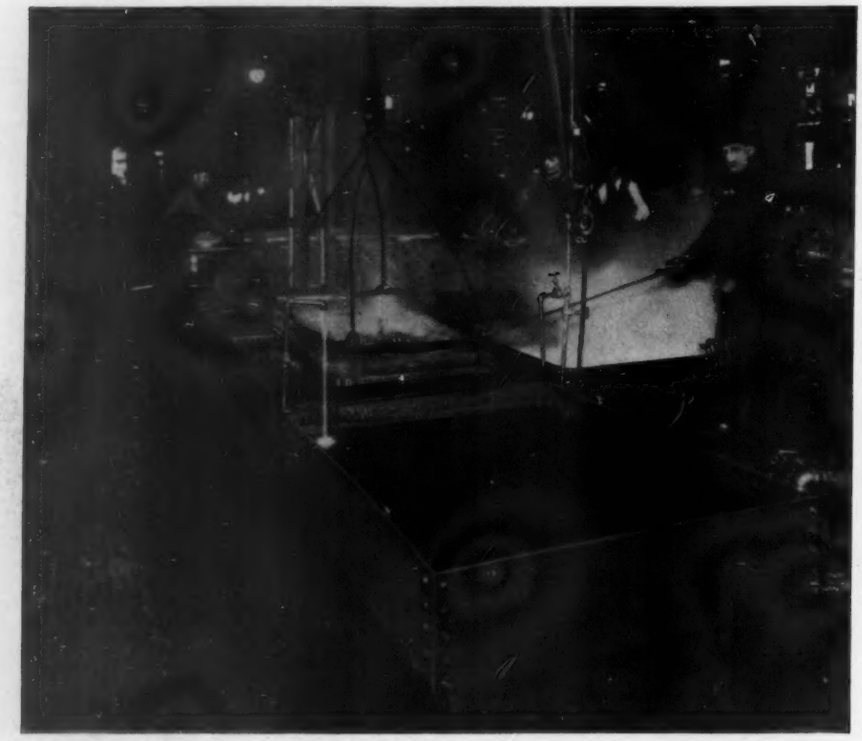


FIG. 8—QUENCHING TANKS IN PLANT OF TIMKEN-DETROIT AXLE CO.

dening temperature. The tensile strength and elastic limit also will show as great a percentage of loss.

When heated high above the transformation point, the grain of the steel at first becomes crystallized, then microscopic cracks are produced between each crystal, the cracks next enlarging in size. Microscopic examination plainly shows this change in the grain structure. In Fig. 1 the hardening temperature was correct, while in Fig. 2 it was 50 degrees too high; in Fig. 3 it was 100 degrees, and successively 200 degrees too high in Fig. 4; 300 degrees too high in Fig. 5, and 400 degrees too high in Fig. 6.

Restoring the Grain

Before the cracks occur the steel can be restored to its former fineness of grain by allowing it to cool and then reheating it to the transformation point and again quenching the piece. If steel is not heated to a sufficiently high temperature to harden it, it can be reheated to the correct temperature and again quenched, without injury to the metal. All of this adds to the cost of production, however, and it is much more economical to install furnaces and apparatus with which accuracy can be insured the first time. With the correct equipment this accuracy usually can be obtained on larger quantities of material and with cheaper labor, than is possible by the same expenditure with the older and cruder methods.

When the temperature of the metal has been raised high enough to develop cracks, its good qualities can be brought back only by remelting and rerolling, or reforging the steel.

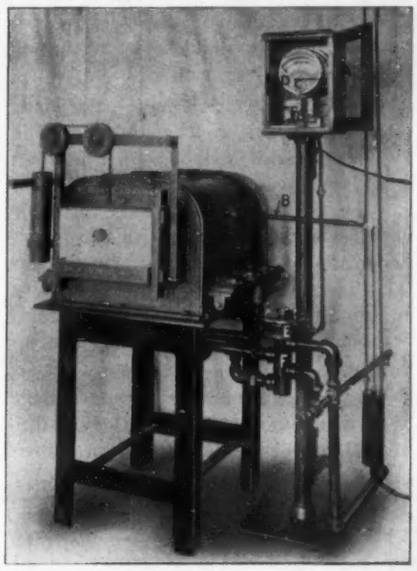


FIG. 10 — AUTOMATIC TEMPERATURE REGULATOR ATTACHED TO GAS FURNACE

FIG. 11—BATH FURNACES USED BY THE STUDEBAKER CORPORATION, DETROIT

With the old forge fires, or furnaces in which an accurate temperature cannot be maintained, it is almost impossible to get the hardening temperature within 100 degrees of the correct point. Even a larger variation may be made between the darkness of winter mornings and evenings and the bright light of midday, when judging the temperature from the color of the steel. A cloudy day and one of bright sunshine also will make a difference, and likewise a black thunder cloud obscuring the light. With this variation of 100 degrees nearly one-third of the inherent strength of the steel is sacrificed. Thus it is necessary to

FIG. 12—ELECTRICALLY-HEATED OVEN FURNACE, TREATING RING GEARS

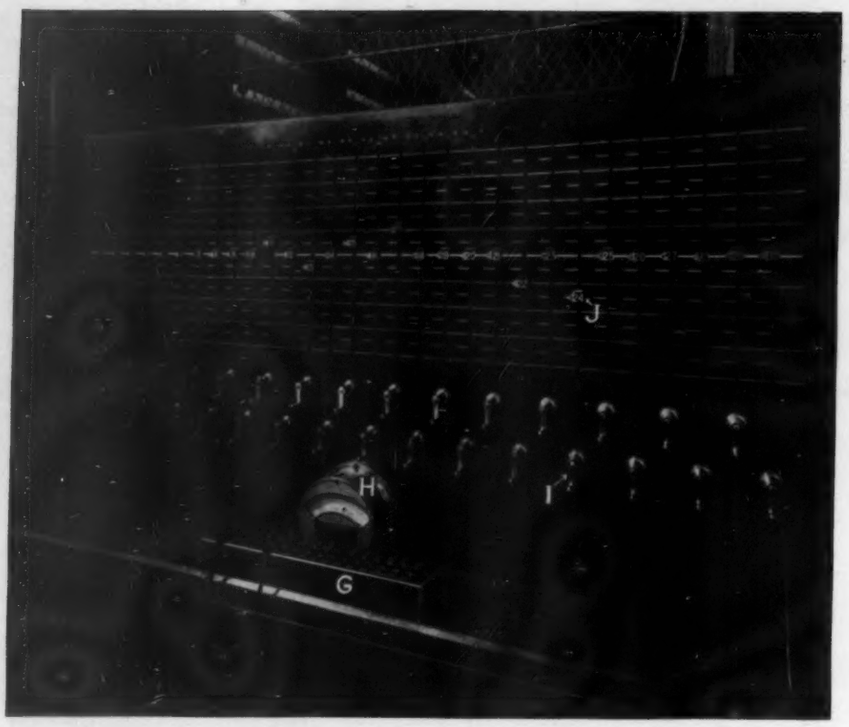


FIG. 13—SWITCHBOARD OF PYROMETER SIGNAL SYSTEM IN PLANT OF STANDARD TOOL CO., CLEVELAND

make the steel pieces larger in size than would otherwise be necessary. This means using more pounds of steel than should be required and thus increases the cost of the tool or machine into which it may enter.

Accurate Drawing Temperatures

Accuracy in the drawing temperatures also is often neglected, and the apparatus for controlling this is so simple that failure to use it is inexcusable. A variation of 50 degrees in the drawing temperature will alter the tensile strength and elastic limit of ordinary carbon steels approximately 5,000 pounds per square inch and the better grades of steel will be affected to an even greater extent. Too low a drawing temperature will leave the steel too hard and brittle and then it is too easily broken when put under strains of various kinds. Too high a drawing temperature will make the steel too soft, reducing the stiffness and resiliency below that desired and, therefore, will make it bend too easily under strains. Here, again, needless expense would be incurred owing to the necessity of making the piece larger than necessary in order to give it enough more square inches of area to withstand the strains.

Carbonizing Temperature

An accurate temperature at which to carbonize steel also is important. Carbonizing usually takes many hours and this temperature should be maintained accurately during that period. If the temperature is too low, the carbon does not penetrate the steel as fast as it should, nor to the desired depth. Hence time and labor are wasted by this inaccuracy. If the temperature is too high, the carbon does not penetrate uniformly, decarbonized spots are more liable to occur and the grain of the steel will be made so coarse that its strength will be materially reduced.

Great improvements have been made in recent years in the furnaces and apparatus with which to heat-treat steel. Accuracy in temperatures now can be obtained that was impossible with former methods. With the greater accuracy obtainable in heat-treating rooms provided with modern equipment, a reduction in the cost of manufacturing also has been accomplished.

Accurate temperature furnaces have been made more economical by utilizing all of the heat and by not allowing 50 per cent or more to escape

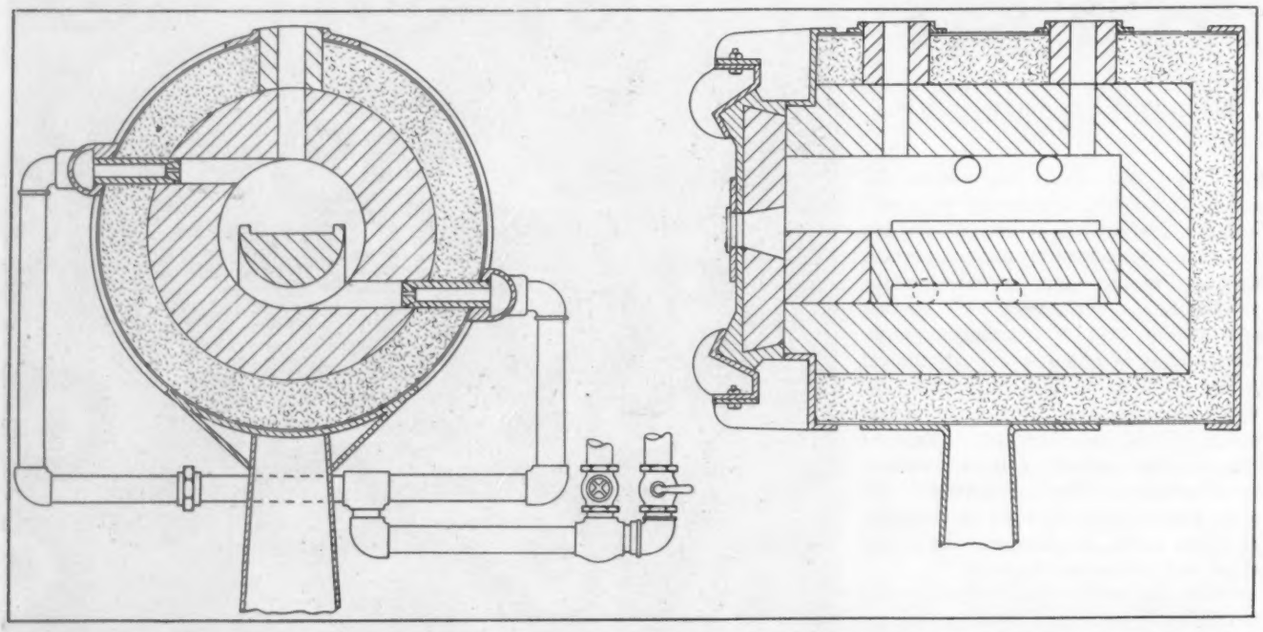


FIG. 14—SECTIONAL VIEWS OF CYLINDRICAL FURNACE; CROSSWISE THROUGH BURNERS, AND LONGITUDINALLY THROUGH CENTER OF FURNACE

through the flue and into the chimney, as was the case with the older and cruder furnaces and forge fires. Heat measuring and regulating instruments have been added to maintain the temperature at the point desired and fuel economy is effected by not allowing the heat to rise above the required temperature. In some of the latter types of furnaces, the heat is passed from one furnace to another, and thus is made to do double duty. Fuels are pre-heated before being burned. Super-heated steam is used for the blast. Both high and low pressure air blast is combined with the fuel in the correct proportions, thereby utilizing all of the heat units. With these and other improvements the pounds of steel heat-treated, per dollar's worth of fuel, is greatly increased. At the same time, cheaper labor is employed, as the improved apparatus does a large part of the work formerly accomplished by skilled labor, and does it better.

Furnace Improvement

One of the latest improvements in furnace design is shown in Fig. 7. This equipment has been installed in the plant of the Root Spring Scraper Co., Kalamazoo, Mich., by the Industrial Furnace Co., Detroit. The flat stock from which scraper springs are made is ½ inch thick, 6 inches wide

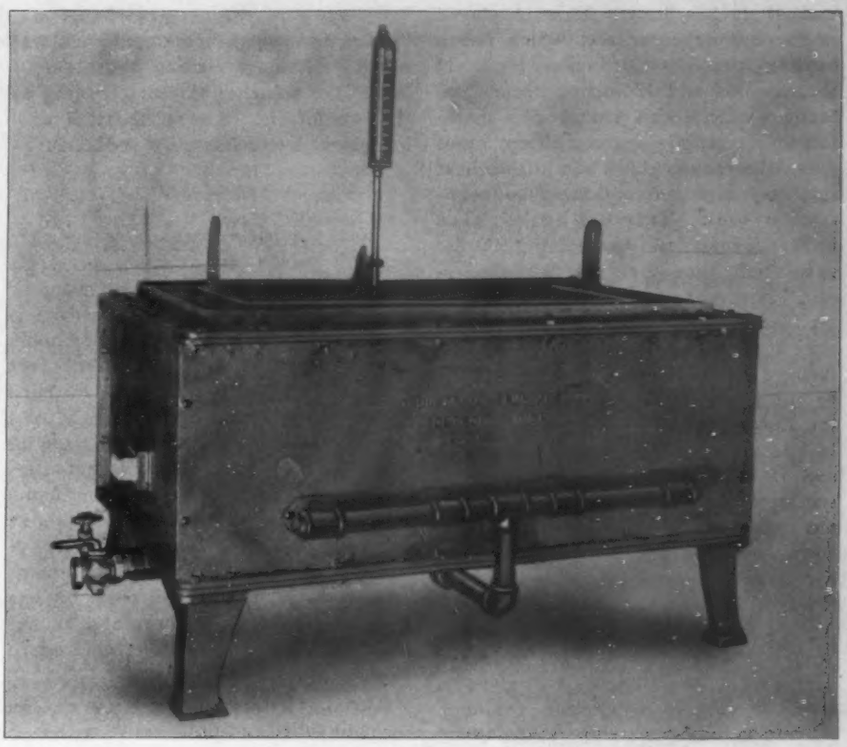


FIG. 15—OIL TEMPERING FURNACE

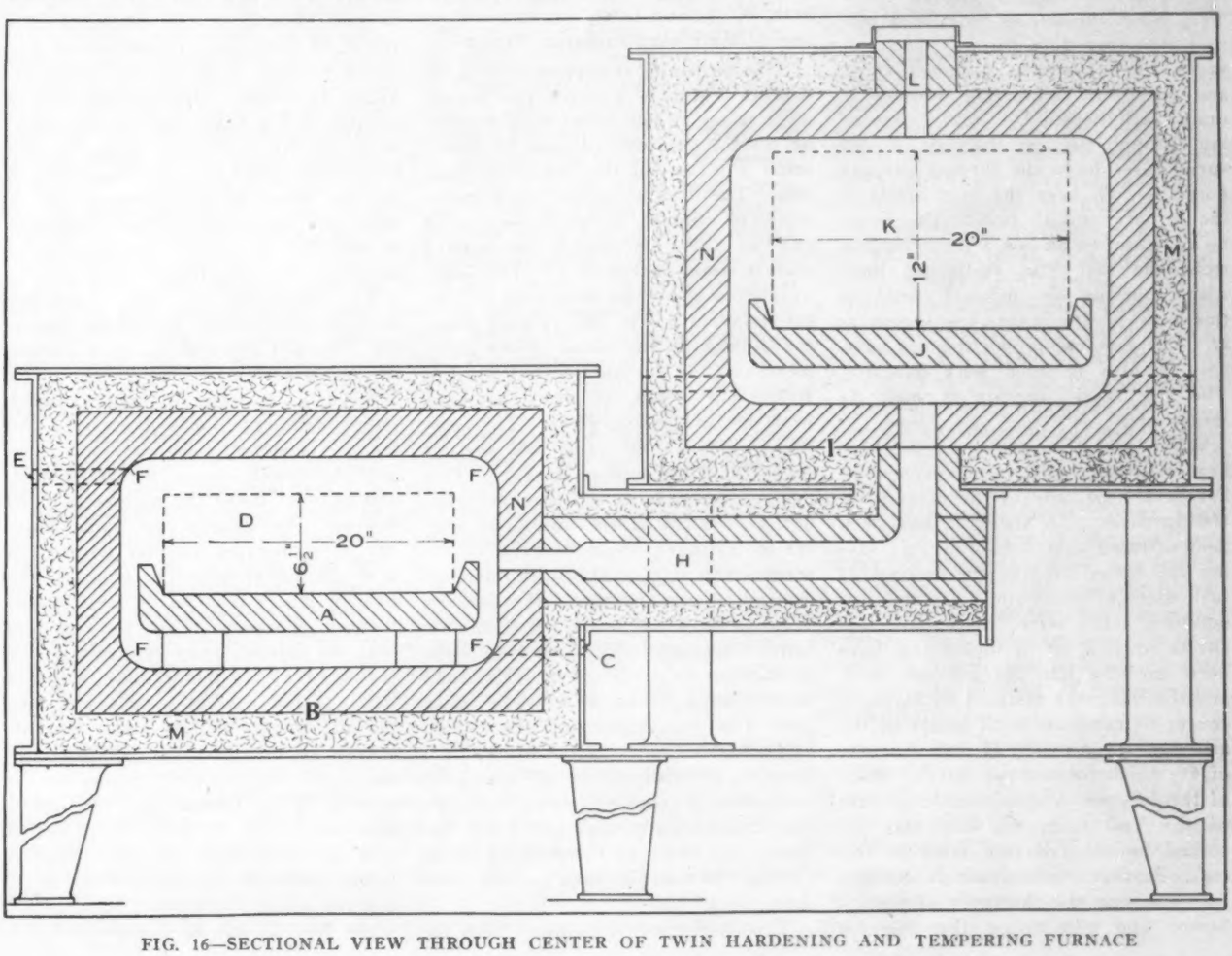


FIG. 16—SECTIONAL VIEW THROUGH CENTER OF TWIN HARDENING AND TEMPERING FURNACE

and 41 inches long. This is placed in the low type furnace, which has a heating chamber 10 inches high, 20 inches wide and 42 inches deep. The temperature of this chamber is maintained at 1,700 degrees Fahr., and when the spring plates attain this heat they are removed and bent to semicircular form. They are again placed in this furnace and heated to 1,500 degrees Fahr. and then are quenched in oil to harden them. The spring plates next are placed in the high type furnace for the tempering operation. This furnace is heated to 700 degrees Fahr. by the gases that have passed through the low type furnace. Thus the same fuel is used for heating both furnaces and is made to do double duty. A sectional view through one of the four gas passages is shown in Fig. 16. Burners inject the gases underneath the hearth, *A*, of lower furnace, *B*, through opening at *C*; also into the top of heating chamber, *D*, through openings at *E*. By the aid of round corners, *F*, the flames are given a swirling motion in heating chamber, *D*, and a uniform temperature is insured at the top, bottom, sides and center. The correct placing of the burners insures a uniform temperature lengthwise of the heating chamber. After the flames have been utilized here they pass through four passages, one of which is shown at *H*, and enter the tempering furnace, *I*, underneath hearth, *J*. After circulating through heating chamber, *K*, the spent gases leave the furnace through ports, *L*. To keep the heat inside of the furnace and to reduce the losses by radiation to as low a point as possible, the cast iron shells are lined with asbestos or mineral wool, a thickness of 2½ inches, as shown at *M*. The case containing the gas passage *H*, also is lined with asbestos. The fire brick interior is built as shown at *N*.

While asbestos is one of the best heat insulators and is inexpensive, it has been used only in the most modern furnaces. In these it has been demonstrated that a considerable saving can be effected in the amount of fuel used to maintain a given temperature. In some cases, asbestos sheets, only ½ or ¼ inch thick, have been used to line the furnace shell, and the heat was retained by laying a course of common brick inside of the asbestos, while inside of that a course of fire brick formed the interior walls of the furnace. A considerable amount of the heat from the fuel was absorbed by the common brick in this case. Further experiments proved that by increasing the thickness of the asbestos and eliminating the common brick, most of the extra fuel that was used in heating the common brick was saved. Thus by making the asbestos from 1 to 4 inches thick, according to the size of the furnace, the fuel consumption is considerably reduced.

Cylindrical Furnace

The cylindrical furnace is another type in which an accurate temperature can be maintained with a minimum amount of fuel. This furnace is used for the hardening heat for tools and small work. The gas-fired furnace built by the Industrial Furnace Co., Detroit, is shown in Fig. 9, and two sectional views are illustrated in Fig. 14. The absence of corners imparts a swirling motion to the flame when the burners are located above or below the center of the circle. A uniform temperature can be maintained owing to the absence of gas pockets caused by corners and an extra amount of fuel is not required to heat this additional space.

The temperature gas furnaces can be controlled automatically within 5 degrees of a given point to which the instrument may be set. This temperature control instrument is manufactured by the American Gas Co., Elizabeth, N. J., and is shown attached to one of their oven furnaces, Fig. 10.

If a hardening temperature of 1,500 degrees Fahr. is desired, the instrument is set at that point by a knurled knob on the outside of case, *A*, which turns a screw on the inside mechanism. The thermo-couple of a pyrometer is inserted in the furnace at *B* and its cold junction is surrounded with a water jacket at *C*. The leads pass from this point to meter, *D*. As the temperature in the furnace rises, the pointer on the meter of the pyrometer travels across the dial until it strikes one of the two arms that have been set at 1,500 degrees. This arm then opens an air valve and the air moves a diaphragm in case *E*. This diaphragm operates a sleeve in cylinder, *F*. As the sleeve raises and lowers in cylinder, *F*, it reduces or increases the size of the port openings that admit gas and air to the burners. Thus, when the temperature of the furnace reaches 1,500 degrees the flame at the burner is lowered. The indicator pointer then will travel back until it strikes the second arm, which again opens the ports. A travel of 5 degrees on either side of the 1,500 is all that is required to trip the arms that automatically raise and lower the flames and thus the temperature inside of the furnace is kept within that limit.

This instrument does away with the skill of hardeners in judging temperatures. All that is required of an operator is to keep the steel in the furnace long enough to absorb all of its temperature and then bring it out and plunge it in the quenching tank. The foreman can set the instrument quickly at the required temperature and the operator need have no knowledge of what this temperature is. None of his time is taken up in adjusting valves to keep the temperature right and consequently more work can be turned out in a day's run.

Another economical method for accurately controlling the temperature of furnaces is used by the Standard Tool Co., Cleveland. It is economical, however, only where a large number of furnaces are in use. The principal of operation is illustrated by Fig. 13. Only one pyrometer meter, and the switch and signal board here shown, are required to keep 30 furnaces operating at the correct temperature. This is located in one corner of the hardening room and is partitioned off from it by a wire screen. A girl continually plugs into one switch after another to get the temperature of each furnace. Thermocouples are in all furnaces in the hardening room and these are connected to switchboard, *G*. By plugging into the right hole, the temperature of any given furnace is given on meter *H*. When this temperature is found it is recorded on a chart and nothing further is done if this agrees with the correct temperature that has been marked on the chart by the foreman. If it does not agree, the furnace operator is signalled to adjust the valves and to make the temperature right.

To better describe the signaling, we will take furnace No. 24 for example. The girl plugged the hole marked 24 on switchboard, *G*. The chart showed her that the foreman wanted a temperature of 1,500 degrees. The meter registered 1,470 degrees. The girl immediately turned the crank at *I*, and brought down the pointer at *J*, 30 degrees. In exactly the same manner, this operated another pointer on a single signal board in front of the furnace where it could be seen by the furnace operator. This showed him that the furnace must immediately be regulated as its temperature was too low. If not correct in a short time, the girl rings a bell to attract the attention of the foreman. On this signal board each number represents the number of the furnace and each white line represents 10 degrees. Thus it will be seen that the last reading found furnaces No. 11 and 15 at 10 degrees above the correct temperature while No. 22 was 20 degrees too low

With this system only one ordinary indicating meter is required to take care of 30 furnaces, most of which are running at different temperatures. A daily record also is made and filed. Thus the temperatures of all the furnaces are available for every day in the year, and for every few minutes throughout the day. The company thus is enabled to find the exact heat-treatment that was given any piece that may have failed after being put into use. The human element has been chosen to make these records rather than some complicated, delicate and expensive apparatus. At the same time, the human element can be used for insisting that the furnace operator maintain the correct temperature by adjusting the valves to correct any error.

Lead Bath Furnaces

Lead and salt bath furnaces have been adopted by some of the shops that always are seeking the best and latest equipment. In these the lead or salt is held in an iron or steel pot that sets into a furnace. The flame surrounds this pot, melts the lead or salt and heats it to the temperature desired for hardening. As the flames do not come in contact with the steel, any of the products of combustion cannot attack the metal to destroy some of its physical properties, and the oxygen in the atmosphere cannot reach it to form a scale. It is much easier to maintain a uniform hardening temperature and the work is heated up to this temperature more quickly than in oven furnaces. Thus more work can be turned out during a day's run, as both time and labor are saved. No scale has to be removed from the work after it is hardened, and time and wear of emery wheels are saved on the pieces that are ground later.

In the No. 1 plant of the Studebaker Corporation, Detroit, the lead and salt bath furnace is used for hardening practically all of the automobile parts that require this treatment. A battery of these furnaces is shown in Fig. 11. Each furnace has a thermocouple inserted in the bath, and the leads run to an indicating meter hung on the wall. One man watches these pyrometers and keeps each furnace at its correct temperature. Thus the work is turned out accurately and at a low cost of production.

Quenching Baths

Oil, water and brine quenching tanks which accompany hardening furnaces also are important factors for correct hardening and these have been greatly improved in the last few years. When the quenching liquid gets too hot the steel is not cooled quickly enough and hence does not have the proper degree of hardness. An excellent installation of this kind is in the plant of the Timken-Detroit Axle Co., Fig. 8. The liquid in the quenching tanks is circulated by continually pumping cool liquid in and allowing the hot to overflow into a larger tank, where it is cooled and brought back through the pump. Thus the heat, conveyed to the quenching liquid by the hot steel, is carried off and that in the tank is always kept below a temperature of 100 degrees. Each tank is provided with a wire basket into which the work is thrown. When full, the basket is lifted from the tank by a hoist and the work is dumped into trucks or cars that convey it to other parts of the shop.

The Strong-Carlisle & Hammond Co., Cleveland, has designed a portable tank, in a single unit, which circulates the oil and keeps it cool by means of a water jacket in which the water is continually circulated. A pump is a part of this unit and this keeps the oil and water in circulation. This is a practical and economical method where the work is not too large.

Tempering Furnace

Fig. 15 shows an accurate and economical type of tempering furnaces for temperatures below the flash point of oil. This is constructed of iron castings, asbestos and fire brick, on the same general lines as the furnace shown in Fig. 16. The flame, however, surrounds a cast iron pot in which the oil is heated to the desired temperature. The thermometer records the degree of heat in the bath and an adjustment of the burners will keep this at the correct temperature. For temperatures above the flash points of oils, a bath composed of a combination of salts, such as potassium nitrate and sodium nitrate, gives even better results than oil in drawing the temper of steel. These can be used for temperatures as high as 1,200 degrees Fahr.

Electric Furnaces

The electric current has been adopted for heating various types of furnaces with more or less success. Some of the furnaces are of the oven type, while others have used a salt bath for hardening temperatures, and an oil bath for drawing the temper. Electricity is an ideal fuel to use, as it requires no blast; it is easy to regulate for temperature and gives off no smoke, dust, gases or bad odors; nor does it heat the heat-treating room as much as furnaces that use other fuels. A neutral atmosphere always is maintained in the heating chamber and the steel does not oxidize or scale, nor are gases present to injure the steel. The electric furnace is unsurpassed where quality is the prime factor, but the cost of current in many districts militates against its adoption.

New Oven Type Furnace

A novel type of oven furnaces has been installed in the Timken-Detroit Axle Co.'s plant by the Hoskins Mfg. Co., Detroit. One of these furnaces is shown in Fig. 12. A battery of four furnaces has been in use more than five months, for heating ring gears to the hardening temperature; 75 pounds of gears are heated every hour of a 10-hour day in each furnace. The electric current costs 1¼ cents per kilowatt and each furnace consumes 13 kilowatts per hour. The fuel cost, therefore, is only a trifle over 0.2 cent for each pound of steel heated to this hardening temperature. The company reports that decarbonizing spots and warpage have been almost entirely overcome. When all other factors are taken into consideration, including the labor expended in keeping the shop clean, it might be possible to figure a saving by the use of electric furnaces. This would depend largely on the kind of work, the design of the furnace and the cost of current. On razor blades, one company reports that it hardens three tons of steel per week, with six electrically-heated salt bath furnaces and two operators, whereas, it formerly required 65 special machines using gas and air blast and 15 men to harden the same number of pounds.

From the numerous illustrations given, it is evident that time, money and labor are wasted by adhering to the old, crude furnaces or other heat-treating apparatus which are costly in their fuel consumption and cannot give accurate results.

The Mississippi River Power Co., builder of the dam at Keokuk, Ia., across the Mississippi river, has issued a book describing the project, which will prove of interest to electrical engineers and manufacturers. It describes in detail the building of the dam and the method of transmitting the power.

Orders have been received by the Mesta Machine Co., Pittsburgh, from the Girard Iron Co., Girard, O., and the Wisconsin Steel Co., Chicago, for equipping their blowing engines with air heads containing the new Mesta plate valves.

Application of New Universal Tool Room Lathe

Lodge & Shipley Model Provided With a Large Number of Attachments Not Required on Lathes for Manufacturing Purposes

THE NEW universal lathe, designed especially for tool room work, built by the Lodge & Shipley Machine Tool Co., Cincinnati, is provided with certain attachments not required in lathes for manufacturing purposes. The unit system of construction is employed throughout so that the application or omission of various attachments which can be furnished, will in no way affect other parts. While the nominal size of the lathe is 16 inches, it actually swings 18½ inches, and to meet the requirements of various users, different types of headstock may be used, namely, four-step and five-step cone single back-geared, three-step cone double back-geared and selective head for single pulley belt or motor drive.

The 16-inch by 6-foot selective head tool room lathe, with complete additional equipment, comprising pan, universal taper attachment, universal relieving attachment, translating gears for cutting metric threads in addition to English threads, draw-in chuck with collets and step chuck with closer, is illustrated in Fig. 1. Fig. 2 shows the 16-inch by 6-foot four-step cone head universal tool room lathe without additional appliances. The selective head, when driven by constant speed belt or motor, gives 12 changes of spindle speeds, which are obtainable through conveniently located shifting levers.

The double nose for the spindle is used in both selective and the cone head lathes, which provides a pilot for centering the chuck or face plate and a large diameter of shoulder against which the plate is screwed. As illustrated in Fig. 2, the main housing of the cone head is carried up slightly above the center line of the spindle.

In each of the different styles of heads, the back gearing is designed to give uniform progression over the entire range of speeds. On the three-step cone head the double back gearing is moved lengthwise by a lever on top of the headstock cover. In the selective head the back gearing is located at the front of the head and the face gear pinion may be withdrawn from mesh. The spindle bearings are made of special white metal and are fitted and held into the headstock by screws. Oil wells are provided over the spindle and back gear bearings and a wick oiling system delivers the proper quantity of oil by capillary attraction.

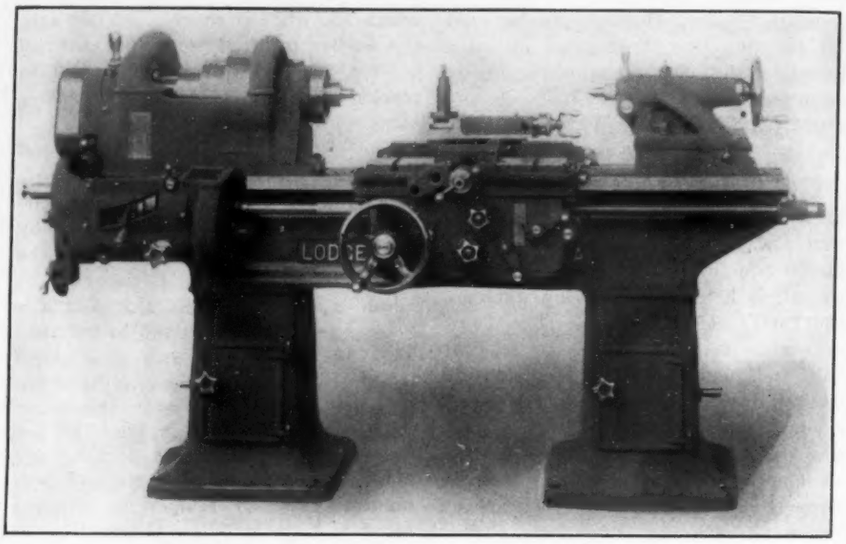


FIG. 2—FOUR-STEP CONE HEAD UNIVERSAL TOOL ROOM LATHE

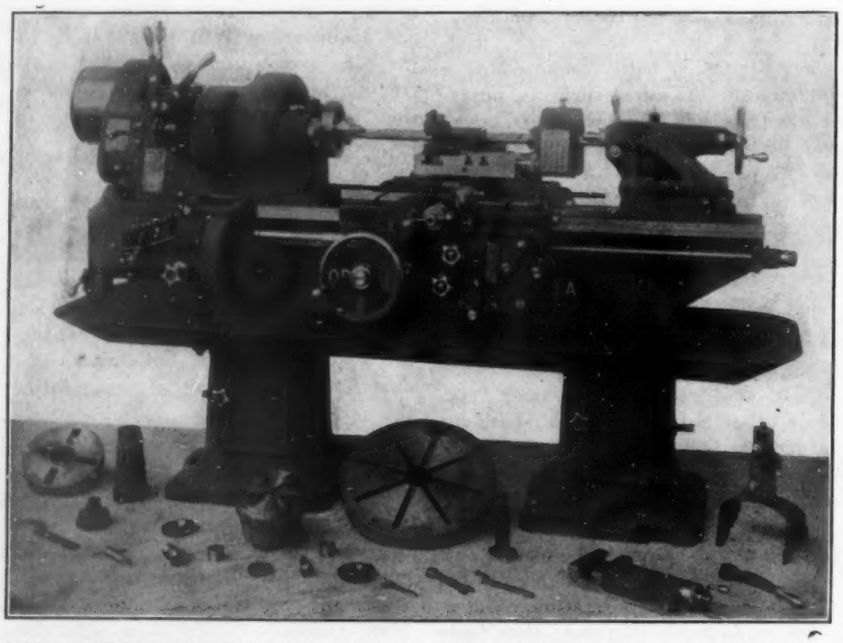


FIG. 1—SELECTIVE HEAD UNIVERSAL TOOL ROOM LATHE WITH ATTACHMENTS

The tailstock has a long bearing on the bed and is designed to allow the compound rest to be set at 90 degrees when using the tool on small diameters. The bed is of box section and the legs are set in from the ends. The ways are chilled, thereby greatly increasing life of alignment. The 6-foot bed has three girders, which are of the inverted U type. A planed pad is located directly underneath the headstock and receives the quick-change gear box, which is tongued and bolted to it. A coarse pitch steel rack is bolted to the bed directly back of the lead screw.

The carriage, a top view of which is shown in Fig. 3, has an unusually long bearing on the outside shears. It is gibbed at the front, back and inside. The bridge has a supplementary bearing on the inside front shear of the bed for resisting the pressure of the cut and for absorbing the vibration from the cutting tool. An oil trough

is cast entirely around the carriage and shear wipers are provided for the bearing surfaces. The cross feed screw has a large, self-locking micrometer dial graduated to thousandths of an inch.

The compound rest top slide is provided with a large self-locking micrometer dial graduated to thousandths. It is designed so that the extreme width of the swivel rests directly upon the lower slide, thereby avoiding overhanging of the top slide. The apron is of the double plate type and the hand wheel for imparting hand motion to the lever can be disengaged from the stem while chasing. The apron is tongued and bolted to the carriage. An entirely new quick-return of the carriage for screw cutting is embodied into the design of this machine and is incorporated in the apron. The reverse is by friction and is controlled by the movement of the same lever which opens the half nuts. By raising the half-nut lever the carriage stops.

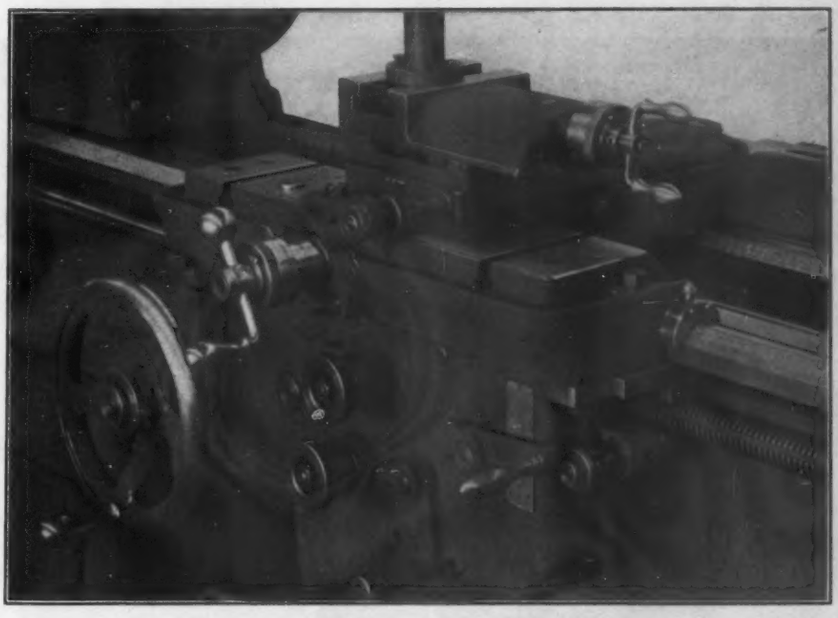


FIG. 4—AUTOMATIC CHASING STOP

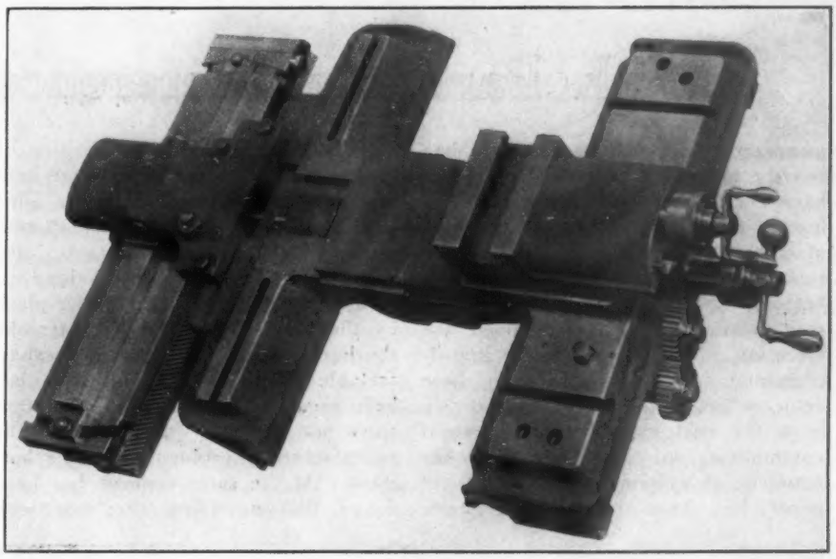


FIG. 3—TOP VIEW OF CARRIAGE WITH UNIVERSAL TAPER ATTACHMENT

A new design of chasing dial is provided which has a hardened notched disc, mounted upon the shaft and secured to a worm wheel, which engages the lead screw threads. This notched disc has a longitudinal movement and any selected index may be engaged with the stop dog, which prevents the half nuts from becoming engaged until the proper notch in the disc is presented to the dog.

The automatic chasing stop, which is attached to the dovetail of the carriage by a clamping screw and is directly connected to the lower slide of the compound rest, is shown in Fig. 4. Its function is to form a dead stop for succeeding cuts over the thread. The rate of advancement or depth of cut can be adjusted to a thousandth of an inch by knurled screws and this cut may be varied from 0.002 to 0.01 inch of depth.

The quick-change screw cutting and feeding attachment is bolted to a pad on front of the bed underneath the headstock. This attachment has two shaft centers, one for the lead screw and the other for the cone of steel gears. Power is transmitted from a feed gear on the end of the spindle through a reverse plate to the stud in the headstock, then through a quadrant mounted on the end of the gear box, which gives three changes. The gear box itself gives 30 changes and with the quadrant compounding, 90 changes are provided in the regular quick change mechanism.

With the metric index it is necessary to make the cone of gears the drivers, whereas in the English index the cone of gears is made the driven. When supplying the machine with metric attachment it is only necessary

(*Continued on page* 83.)

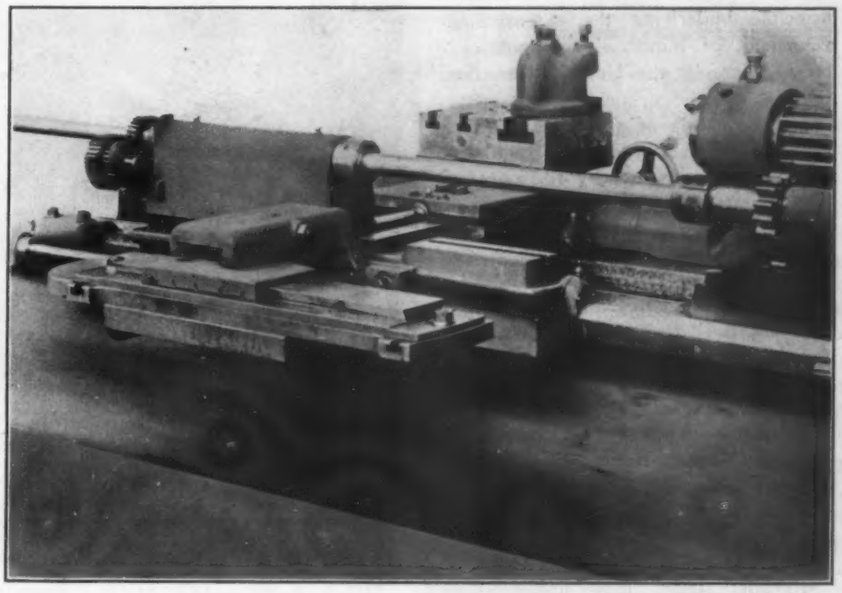
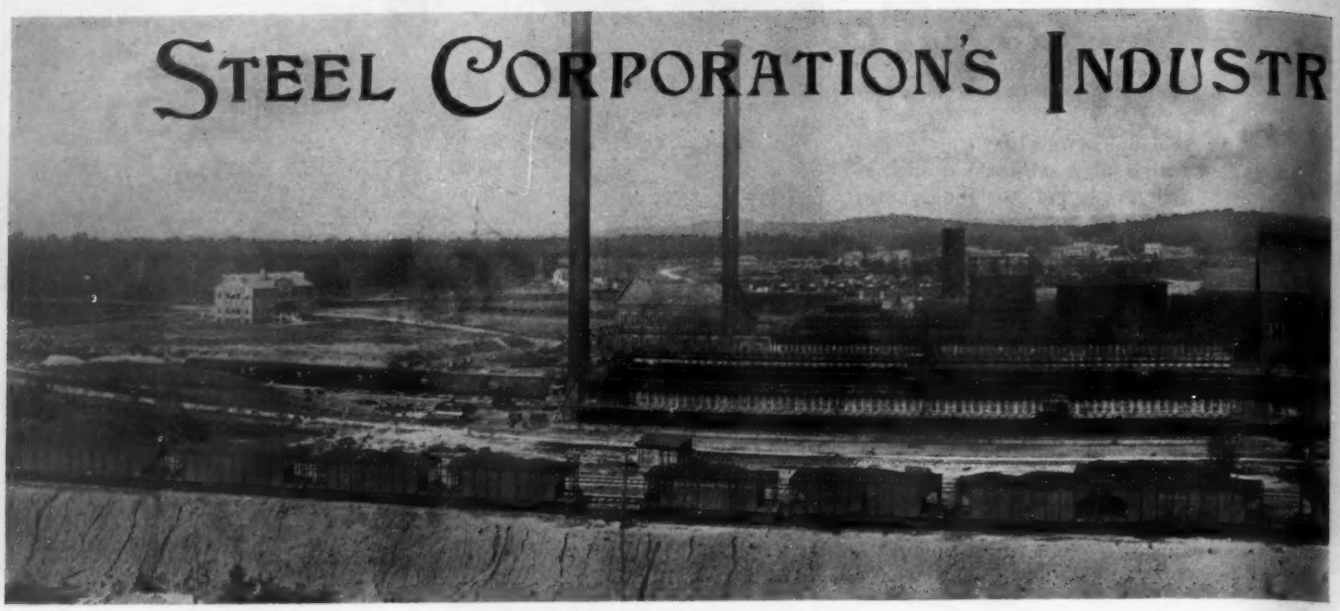


FIG. 5—UNIVERSAL RELIEVING ATTACHMENT

STEEL CORPORATION'S INDUSTR



Panoramic view of the by-product coke plant of the Tennessee Coal, Iron & Railroad Co. on the outskirts of Fairfield, Ala. The

With Particular Reference to

AID FOR EMPLOYES

"The United States Steel Corporation, while organized for profit, is, at the same time, seeking to promote the health and happiness of its employes and to encourage them to be good citizens."—E. H. Gary, chairman, United States Steel Corporation.

A contented man is the best citizen; furthermore, he is the most efficient employe. These two propositions, in order, represent the fundamental principle underlying the extensive development of industrial communities in recent years by the United States Steel Corporation.

The demands of the iron and steel industry, from a manufacturing standpoint, have been met by the construction of great works, each in turn the product of the highest engineering skill of the day. Successively, each new plant has raised the standard of mechanical efficiency and has extended and improved the processes that make for both quantity and quality. Conservatism of energy and of every element possessing commercial value, has been so advanced in manufacturing that the experiences of Homestead have become the profits of Gary and the potentiality of Gary will now add to the greatness of the new plant at Corey, at Duluth and at Ojibway.

Parallel with this unprecedented manufacturing development, there has run the materialization of plans which have been concerned wholly with the human factor of iron and steel manufacture. Safety at work, the opportunities for recreation, the financial betterment and the home life of the men of the mills, have claimed the attention of the most expert knowledge and advice available upon these subjects. Suggestions have been drawn from the best examples of industrial communities of Europe and other countries. A systematic and permanent effort has been made to improve morally and materially the position of the men who represent the labor item in every ton of iron and steel. This work has accomplished some signal results.

The end sought in the development of modern and scientific housing plans by the Steel Corporation, is to make the home life of the employe as comfortable as possible. This aim has been regarded by officials of the company as distinctly apart from the manufacturing problems of the business. At the same time, it has been found that providing the men with

FIG. 1—A WELL-ARRANGED SIX-ROOM HOUSE IN THE TOWN OF FAIRFIELD

town of Fairfield is shown in the background and at the right is the plant of the American Steel & Wire Co., undergoing construction

the Creation of Fairfield, Ala.

clean, attractive home surroundings and furnishing them the example and means for enjoying some of the refinements of life, are important influences in making them more contented and better all-around producing units. Idealism is a quality that to some may seem strangely out of place in the average large manufacturing plant, where the press for output and for profits appears always in the foreground. This quality, nevertheless, has been present in a conspicuous degree in the plans for city-building carried out in recent years by the United States Steel Corporation. The greatest problem in providing housing accommodations for its employes, has been found by the Steel Corporation, as well as all other corporations that have interested themselves in the home life of their men, to be how to take care of the unskilled or lowest paid workmen. This question involves much more than the ordinary considerations of providing sanitary surroundings, of encouraging thrift through house-buying plans at easy terms and, in general, of stabilizing labor through favorable working and living conditions. The system of town-building, so far as it has been developed, is successful from the standpoint of the skilled and more intelligent workman earning good wages who it has been found quickly avails himself of the opportunities for betterment placed before him by his employers. Furthermore, it is logical that skilled men must first be accommodated, since upon the maintenance of such an organization depends primarily the success of a plant once that it is in shape for manufacturing. These skilled men, as a matter of course, must come from other more established communities, where they have been accustomed to enjoy comfortable and modern standards of living, and the assurance that both they and their families will obtain equal accommodations in a new town is usually an inducement of great weight in taking them there and in holding them once they are established, other

A GOOD CITIZEN

"A good citizen is one who observes all national, state and municipal laws and is willing to assist in their enforcement. He is honest and fearless. He is loyal to home and friends and country. He does what he can to assist in promoting the moral, intellectual and physical welfare of the people."—E. H. Gary, chairman, United States Steel Corporation.

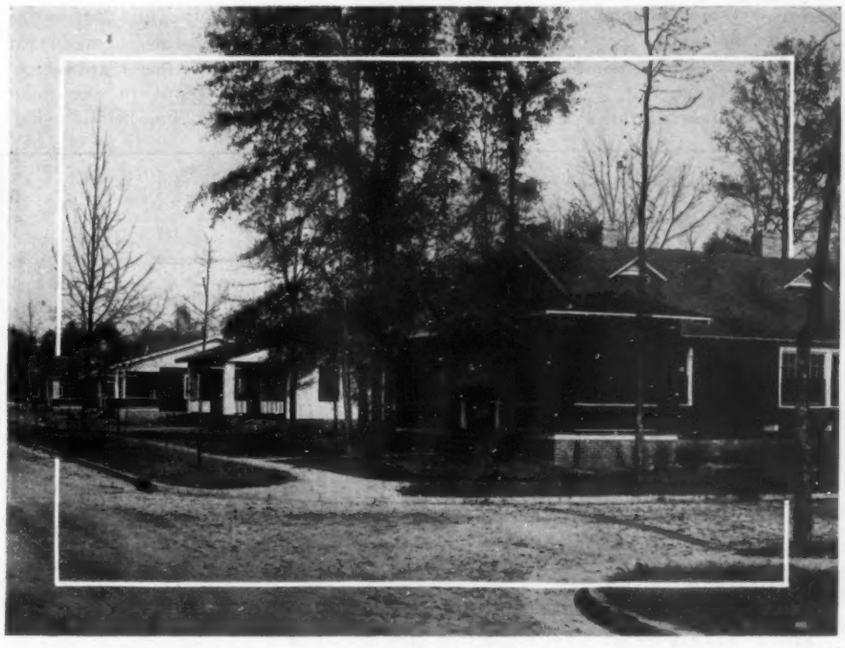


FIG. 2—A GROUP OF FIVE-ROOM HOUSES IN FAIRFIELD

FIG. 3—TWO FIVE-ROOM HOUSES IN FAIRFIELD. HOUSE ON LEFT RENTS FOR $22.50 A MONTH AND THE ONE ON THE RIGHT FOR $25

conditions, of course, being favorable.

In the case of the unskilled man, the Steel Corporation frankly admits the problem is most perplexing and that it will require much patient and thorough study before it successfully can be mastered. Many of these men are of foreign birth and are accustomed to ways of living much different from American standards. Necessarily, by nature of their work, they draw comparatively low wages and they are possessed with the idea of saving as much of this as possible, usually with the purpose of returning later to their native land and of enjoying the fruits of their labor after their own ways of ease and comfort. They, accordingly, adopt modes of living much below that which their employers aim to bring within their reach or wish them to follow. Many of these men are single; in frequent cases, they are men of families and the latter have not yet followed them to this country.

Three types of houses now are being studied by the Steel Corporation in the hope that a plan may be reached ultimately to satisfactorily solve the problem of housing unskilled labor. These plans are as follows:

First.—Houses for occupation by families only, and which can be rented for not more than $2 per room per month.

Second.—Houses for occupation by families which follow the general custom of taking boarders, such houses to be planned for that particular purpose, so that the family quarters may be apart from those of the boarders.

Third.—Dormitories or barracks for men without families, where each man shall have a separate and sanitary room, however small and bare it may be, with common mess rooms, shower baths, etc.

Broadly speaking, there are two general types of new Steel Corporation towns. One of these embraces those towns which are created to serve essentially a temporary or local function such as in connection with the prospecting or development of a particular ore or coal body, or such as are related to enterprises that may in time be abandoned or changed, thereby rendering unnecessary the continuance of the community. These towns seldom develop to permanent municipalities. In some cases, they have shown such a development and have continued their existence as prosperous, self-governing communities. Usually, however, the Steel Corporation assumes all responsibilities of government, shelter, sustenance and general welfare of those who dwell in these virtual camps. Examples of this type of town are to be found in Docena, Bay View and Edgewater in the iron ore and coal fields of Alabama and in Hostetter, Licering, Marguerite and other towns in the Connellsville coal and coke regions. On the Superior ore ranges, the close proximity of the operations of different steel companies and the activity in lumbering and other important industries, affords a variety of interests supporting the town that make for permanent communities.

Permanent Community

The second and higher type of a Steel Corporation town is that in which permanency and scientific completeness form the controlling idea. From the ground up, the latter-day towns of this character have been modeled along lines that make broad and liberal provision for the most modern living conditions of the day and for future betterment and development. These towns are built simultaneously with, yet separately from the works—neither before nor after—as was the case with many of the nondescript mill towns that have come down to the present day from old conditions. In the latter case, the town preceded or followed the mill, and as the works expanded, and the employes increased in number, the community spread out in a rambling, irregular fashion from which much was lacking either in substantial construction or facilities for proper living. The mill was the whole thing. Today it is different. The modern town is built without a population and at the same time that the works are constructed. It forms a most important part of the industrial unit represented by itself and the works combined. As provision is made for future extensions of the manufacturing capacity of a plant in the most economical way as conditions shall

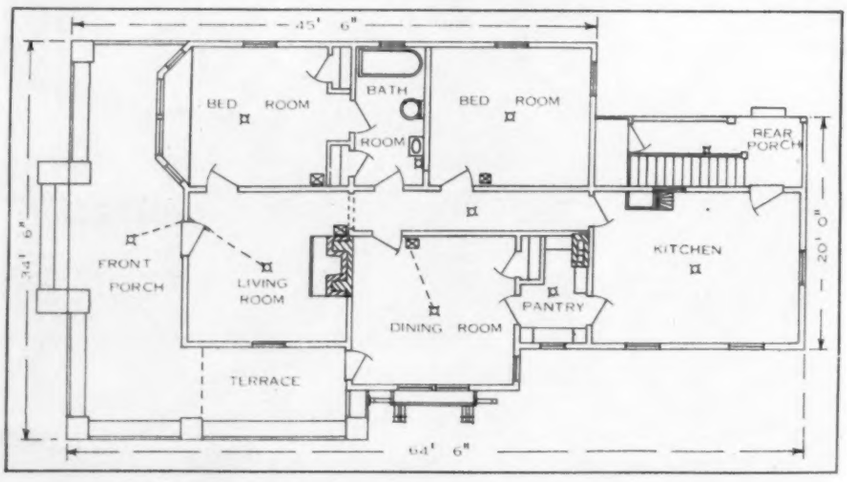


FIG. 4—FLOOR PLAN OF FIVE-ROOM HOUSE SHOWN AT THE RIGHT, FIG. 3

require, so likewise the original layout of the town adequately takes into contemplation the probabilities of later growth in population and area and is determined accordingly. The modern idea is not to allow the works to dominate the whole enterprise. The effect of this method is obvious. The new town quickly assumes a character all its own. In no sense does it become a mere adjunct to the works which furnishes the chief reason for its existence. Its problem of construction and future development is approached from the viewpoint of a full-fledged town, not as a mere mill unit. Every detail of its original layout is studied and executed accordingly. Time, thought and money, lots of each, are not spared to make the town as thoroughly modern in its way as the new plant is strictly up-to-date in manufacturing character. Once the Steel Corporation has discharged its supervision over the budding community, the town quickly transforms itself into a typical American municipality. It chooses its own administrative officers, settles all public questions by the ballot and in general, conducts its own affairs in the manner that the majority of its citizens shall decree.

Fairfield and Gary

In Corey, Ala., or Fairfield, as it is now known, and in Gary, Ind., are represented the most striking examples of what the Steel Corporation has accomplished in recent years in the creation of such well-contained industrial towns. The original development of these towns, however, was accomplished in different ways. Gary was planned and built by a subsidiary of the Steel Corporation, the Gary Land Co. Until it reached the stage where it could run its own affairs, its destinies were guided by that corporation. Fairfield, on the other hand, was developed by a private corporation, the Jemison Real Estate & Insurance Co., Birmingham, Ala., co-operating with the Steel Corporation. The Steel Corporation gave its direct attention to the building of the manufacturing works at Fairfield, while the Jemison company looked after the laying-out and the erection of the town proper. At all times, however, the development of the town itself was shaped by the needs of the Steel Corporation, or rather of its employes, and by the compelling motive to give to the men of the mills the most attractive and wholesome surroundings at a minimum cost to themselves in the interest of a contented and well-ordered industrial community and in general, of a better all-around town.

FIG. 6—SIX-ROOM HOUSE IN FAIRFIELD. MONTHLY RENTAL, $27.50

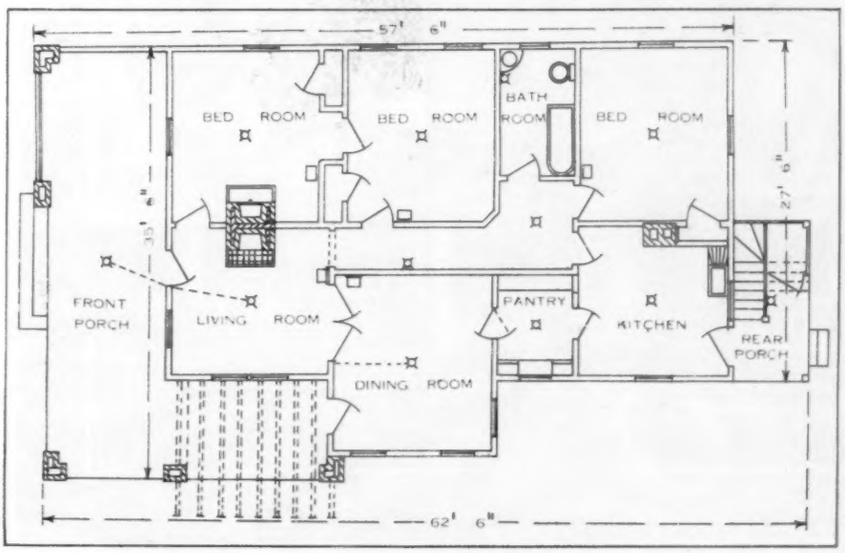


FIG. 5—FLOOR PLAN OF SIX-ROOM HOUSE, FIG. 6

Fairfield is a city built upon cotton fields and wooded slopes. Like Gary, it is a wholly new community created for a definite purpose. That purpose primarily, has been economic. Yet the higher and less material aspects of the undertaking have not been lost upon the builders. In Fairfield has been offered the fullest opportunity for the development of every feature and facility approved by the most modern thought in city planning. A natural beauty of surroundings has added the touch of picturesqueness to the finished accomplishment. Gary, with its sand dunes at the beginning, was an infinitely less promising subject for development than Fairfield with its spreading fields and pretty hills.

The City of Fairfield

Fairfield is the latest and probably best example of city-building from a Steel Corporation standpoint. It surpasses even Gary in the extent of its public works and in the general provision for the workman of modest income. It represents another step forward in the approach toward the perfect mill community. The lessons gained from Gary and other steel towns have been utilized to good purpose in the newer city.

The new city of Fairfield lies southwest of Birmingham and between that city and Bessemer. It is 6 miles from the center of Birmingham, 6½ miles from Bessemer and 1 mile from Ensley. It adjoins a tract of more than 2,000 acres of land acquired by

FIG. 7—GROUP OF FIVE-ROOM, FURNACE-HEATED HOUSES IN FAIRFIELD

the Steel Corporation several years ago for the future development of its southern resources. The town site is served by four southern trunk lines; the Birmingham Southern, the Southern, the Louisville & Nashville and the Frisco system. Its topography is favorable to the development of attractive residential surroundings. On a portion of the site are wooded hills which have contributed much toward the landscape beauty of the town. The manufacturing units of the Steel Corporation recently completed or now under construction, are the plants of the American Steel & Wire Co., to cost $4,000,000 and a by-product coke plant of the Tennessee Coal, Iron & Railroad Co., of an estimated cost of $3,500,000. These works are so located that they directly face Fairfield. To the east of the town are the blast furnaces, rolling mills and steel works of the Tennessee Coal, Iron & Railroad Co., at Ensley. The American Steel & Wire Co. is the first of the Steel Corporation's northern subsidiaries to establish a steel manufacturing plant in the south. Its investment signalizes the growth of the southern steel industry and the development that has been made of the properties of the Tennessee Coal, Iron & Railroad Co., acquired in 1907. This plant of the American Steel & Wire Co. was begun in May, 1910, and after some delay arising from the uncertainty of business conditions, now is in the final stage of completion. It is expected to be ready for operations early in 1914. The plant will have an output of about 10,000 tons of wire products per month. The by-product coke plant of the Tennessee Coal, Iron & Railroad Co. began operations in February, 1912. It consists of a battery of 280 Koppers ovens with a daily output of 4,000 tons, and an annual capacity of 1,250,000 tons, which is used in the furnace plant at Ensley. Adjoining the town of Corey, but not

FIG. 8—GROUP OF FIVE-ROOM, GRATE-HEATED HOUSES IN FAIRFIELD, RENTAL $22.50 PER MONTH

included within its corporate limits, is one of the plants of the Harbison-Walker Refractories Co., of Pittsburgh.

The town of Fairfield has been laid-out and planned with minute attention to every feature of importance in a modern city, where workmen are to make up the great portion of its population. The scheme of the town re-

include a town hall, library, Y. M. C. A., public bath and a training school. The civic group is approached by a wide plaza, which is flanked by business buildings. These structures conform in style to those of the civic group. The plaza is 247 feet long by 150 feet wide and is paralleled by two business streets, which run from Gary avenue—the principal business thor-

main entrance of the coke plant of the Tennessee Coal, Iron & Railroad Co. and to the plant of the Harbison-Walker Refractories Co. The junction of these two streets forms the business center of the town. The park area about the civic center will be developed as the town grows, and requires more recreative space. There has been established or provision

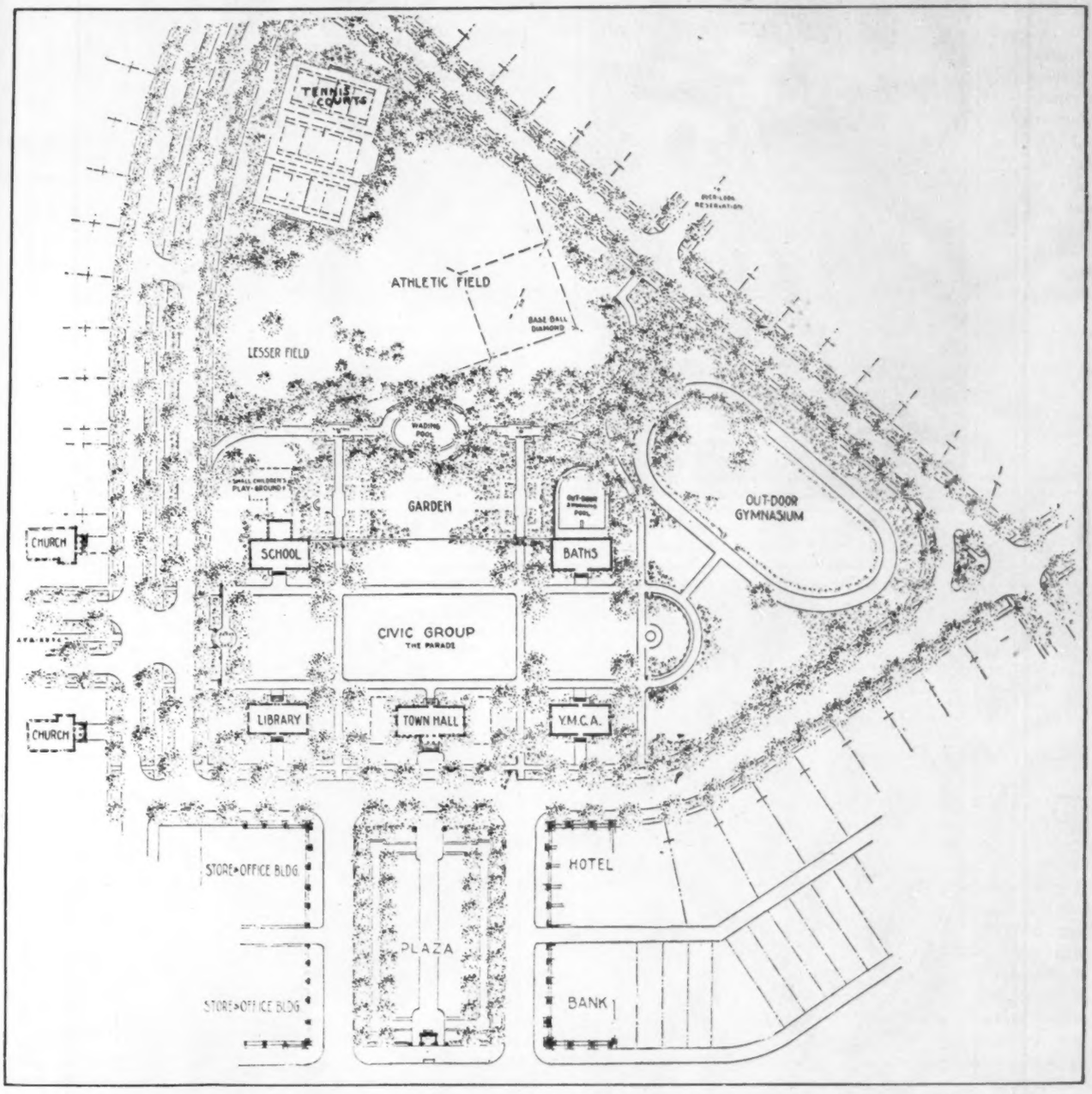


FIG. 9—THE CIVIC CENTER OF FAIRFIELD, SHOWING THE BUSINESS DISTRICT, PLAZA, PARKWAY, ATHLETIC FIELDS AND OUTDOOR GYMNASIUM

volves about a central park area, where are located a civic center, the plaza and the park. About the civic center are being grouped in a quadrangle with an open parade within, the public buildings of the town, all of which it is provided will harmonize architecturally. These public buildings

oughfare—to Carnegie avenue and the civic center. Gary avenue passes through the town to an entrance to the American Steel & Wire Co.'s plant. Near the center of the town, a second important business thoroughfare, Cranford street, intersects with it. Cranford street leads to the

made in this section for wading pools, athletic fields, outdoor gymnasium and other open air pastimes.

The residential section of Fairfield is divided by a system of zones in order to classify the neighborhoods properly with respect to general restriction and valuations, and also to

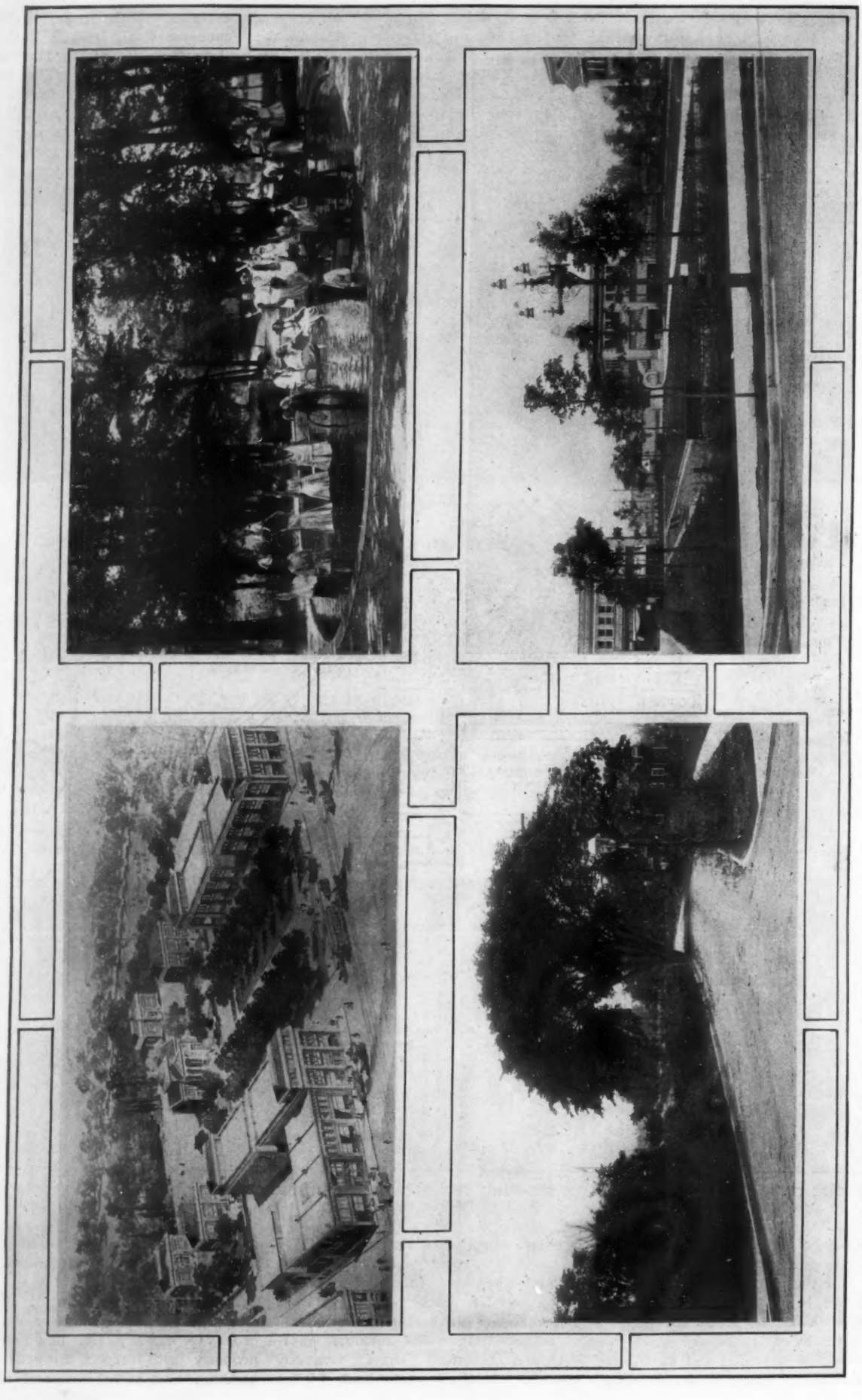


FIG. 11—WADING POOL IN THE CIVIC CENTER
FIG. 13—ANOTHER VIEW OF THE PLAZA

FIG. 10—PERSPECTIVE OF CENTRAL PARK AREA, SHOWING CIVIC CENTER
FIG. 12—PARKWAY WEST OF DE BARDELEBEN AVENUE

make provision for schools, park areas and the general beautification of the town. On the higher land and knolls, the better residential sections are located. The cheapest residences to be built in Corey must cost a minimum of $1,250. In the second zone, it is provided the cost must be at least $1,500; in the next zone, $1,750 and this system is continued carefully until the whole town is subdivided along lines of valuation and of desirability of location.

Houses for Employes

The present population of Fairfield is about 1,200 and an increase of several thousand in this number is expected when the new plant of the American Steel & Wire Co. is completed. The estimated number of employes for the first unit of the wire plant is 1,500. Up to date a total of 168 buildings both commercial and residential have been erected. There are a total of 1,256 lots or 255 acres, 20 miles of paved streets of bithulithic brick, etc., 20 miles of cement sidewalks, uniformly laid and eight and one-half miles of sanitary sewer with a connection for each lot. The building restrictions of the town provide for the residences to be located 25 feet from the front line of each lot. The houses are equipped with every convenience, including furnace or grate heat, hot and cold water, baths with tiled floors, porcelain tubs, cement basement, gas, electricity, laundry and ample lot space.

The Steel Corporation through its subsidiaries, the Tennessee Coal, Iron & Railroad Co. and the American Steel & Wire Co., has completed and now is building in Fairfield a large number of houses for its employes. The Tennessee Coal, Iron & Railroad Co. has finished or under construction at the present time, 31 houses, while the American Steel & Wire Co. is at work on 75 additional dwellings, which now are being rushed to completion in order to be in readiness to accommodate the employes of its new plant, soon to be put in operation. The types of these houses comprise five and six-room bungalows and two-story residences and their cost ranges from $2,500 to $3,000 each. The investment for houses by the American Steel & Wire Co. alone amounts to more than $200,000.

These houses are intended chiefly for the use of the superintendents and skilled men of the by-product coke plant and the wire works. They are of substantial construction and of tasty appearance, architecturally. Every modern convenience, including bath, electric lights, furnace or grate heat, etc., is provided. Because of the mild climate, grates, in many cases, are deemed sufficient for heating purposes. Each house has plenty of space around it and the maintenance of sightly lawns front and rear, and other evidence of tidiness and order are encouraged in every way possible to conform to the general scheme of landscape architecture provided by those in whose charge is the town in its making. These houses rent for $19.50 to $27.50 a month.

Easy Payment Plan

The Tennessee company has formulated a plan by which it offers the ownership of these houses to its men on easy terms of payment. The plan, in general, calls for a small cash payment with an additional payment each month, depending upon the cost of the dwelling and the earnings of the employe. The company retains a mortgage until the house is paid for and charges 6 per cent per annum on deferred payments. The American Steel & Wire Co. intends to follow a similar plan after the houses are completed and when sufficient time shall have elapsed after it begins operations to determine those of its employes who are likely to remain permanently in its service.

Easy Payments

This method of encouraging home ownership and the system of payments follows the general plan which gradually has been developed by the subsidiaries of the Steel Corporation from varied experiences with housing schemes. The monthly installment is made at a rate that offers no hardship to the employe, depending upon his income and also is ample to meet all the requirements of the case from an employers' investment. This rate has been worked out from a large number of cases. In addition to the houses of the Tennessee and American Steel & Wire companies, a number of structures of similar type have been built by private parties for their own occupancy or for investment.

The houses today being erected by the Steel Corporation companies at Fairfield, as previously stated, are for the skilled and the better paid employes. The problem that now presents itself is the accommodation of the unskilled labor and the men of low earning power at terms within their command and in a manner that will be in keeping with the scale of up-to-date living and typical attractiveness generally provided for the new town. Some one or all of the three methods outlined are under consideration and eventually may be called into use. Whatever is done in this direction, from the intelligent and progressive spirit that has characterized Fairfield since its very inception, promises to be well done. The way in which this problem will be approached in the new Alabama steel

The Real Business Problems in Housing Work

"Behind all housing problems lies the most important one of all. An industrial enterprise must be so conducted that it shall earn enough to provide proper working conditions for its employes, to pay fair wages, and to return a reasonable profit to those who have invested their money in it. It seems, sometimes, that this last necessity is overlooked, yet it is as important as anything can be. Not much good can be done by any corporation through excellent working conditions, high wages and good housing of its employes, if the company goes into bankruptcy. All its efforts are brought to nothing and it only becomes an example to deter others from altruistic endeavors. It is easy to forget that the first need of the workman is employment, and that employment depends upon the success of the business which furnishes it.

"The housing of employes requires the expenditure of large sums of money. That money must be taken out of the business. As part of the capital of the enterprise, it must yield returns to those who have invested it. But money invested in building houses for employes will not bring any such return as money employed in the manufacture and sale of products of industry. Therefore, a board of directors is compelled seriously to consider how far it can properly withdraw capital for the construction of industrial houses and villages. It is easy to say that the diminished returns on this capital are made up by larger returns on the remainder of their capital, due to better work done by more contented workmen. We firmly believe this, but it is not a thing which can be demonstrated by the books of account. And when doctrines of discontent are being preached to the workmen in so many ways, it is to be expected that employers must sometimes have misgivings as to their returns from endeavors to make their men healthier, happier and more contented."—C. L. Close, Manager of Safety, Relief, Sanitation and Welfare Department of the United States Steel Corporation.

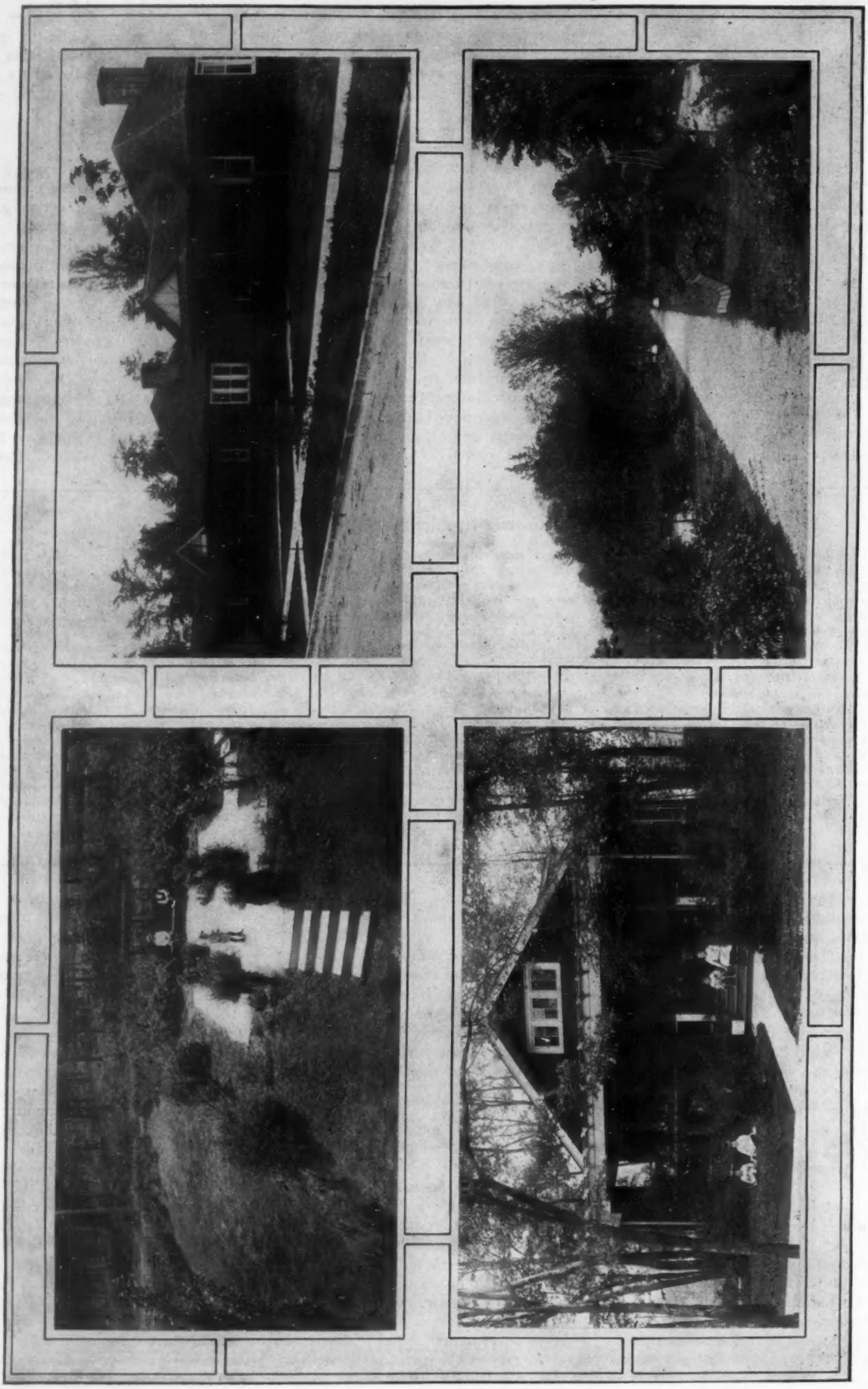


FIG. 15—COTTAGES ON FORTY-FIFTH STREET
FIG. 17—PARKWAY NORTH OF FORTY-FIFTH STREET

FIG. 14—SEVERAL OF THE WELL-KEPT BACKYARDS
FIG. 16—A WORKINGMAN'S HOME IN FAIRFIELD

city in all probability will offer valuable guidance for the Steel Corporation's mill communities that are to follow within a few years or for those the necessity for which is yet to be created by the future progress of the steel industry of the country. The development of Fairfield from this standpoint, consequently, will be watched with keenest interest by all steel companies and other large industrial employers who find their efforts in rounding out housing plans for their employes circumscribed bv this least tractable factor to the success of the whole scheme—the common workman of lowest income.

Application of New Universal Tool Room Lathe

(*Continued from page 73*)

to add a gear cover, into which is mounted the translating gears. When the gear box is arranged for metric pitches, it is possible to cut either metric or English by turning the knob attached to the bottom of the box. By turning this knob to the left, the metric pitches are obtained and by turning it to the right, English pitches are obtained.

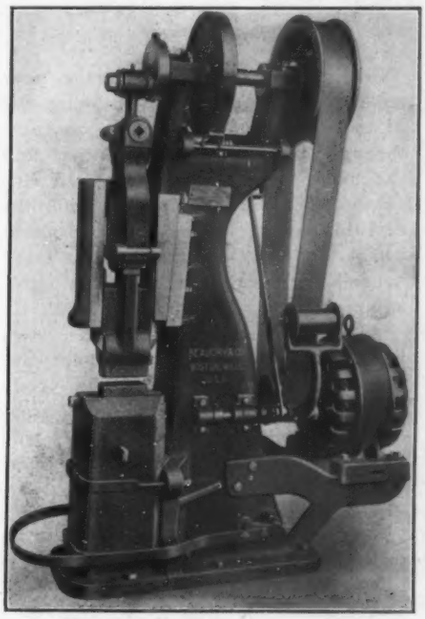
The plain taper attachment requires no strip on the back of the bed and, therefore, a special bed is not essential, the taper adjustment being readily applied to the machine at any time. The bracket carrying the swivel bar is bolted to travel with the carriage so that at whatever part of the carriage the taper adjustment may be, it can be engaged instantly. The taper attachment swivel is a steel straightedge, upon which a gibbed shoe slides, secured to a slide that confines the cross feed screw to it. The straightedge can be set to graduations in inches per foot and a micrometer adjustment is provided to insure extreme accuracy in setting. A graduated steel scale with a compensating pointer gives accurate reading to the swivel bar.

Universal Taper Attachment

The universal taper attachment, fitted to the carriage, is shown in Fig. 3. A cover plate, which protects the rack, and a cover for the gears at the front of the apron, have been omitted to more clearly show the construction of this attachment. The mechanism for imparting power traverse to the swivel bar of this attachment is controlled by a shaft extending through the bridge of the carriage, operated by change gears at the front, driven direct from the apron feed train. The plain taper attachment is satisfactory for tapers not exceeding 4½ inches per foot, but on abrupt tapers it is impossible to drive the tools against such steep angles and to accommodate work of this character an independent driving mechanism to the taper attachment slide has been provided. The complete range of the universal taper attachment covers tapers from 1½ inches to the foot, 54 inches long, to 13½ inches per foot, 6 inches long.

Universal Relieving Attachment

The universal relieving attachment, Fig. 5, is designed to produce radial, angular, end or inside reliefs. Power is transmitted from the splined shaft at the back of the bed through the sleeve and change gears to a shaft below and parallel with the driving shaft. The lower shaft in the housing transmits its power through hardened, spiral gears to the cam shaft, which takes its bearing in the cross slide. This cam shaft engages a roller



MOTOR-DRIVEN POWER HAMMER

mounted in a plunger and this in turn engages a bell crank, which is mounted in the top slide of the relieving attachment. Since power for operating the relieving slide is supplied directly through the swivel center, the swivel itself may be set at any angle without affecting the movement of the slide and thus it is possible to relieve at any angle inside or outside, or on the face of a piece of work. The cam shaft is placed below the surface of the bridge so that the full swing over the bridge is obtained for relieving.

The draw-in chuck is mounted directly on the nose of the spindle and as no draw tube passes through the spindle, it is possible for the draw-in collet to receive stock as large in diameter as the size of the hole through the spindle. A step chuck with adjustable jaws and closer is made to apply to the regular draw-in chuck body and is desirable when a finished piece must be true and also for facing thin pieces of large diameter.

A Motor-Driven Hammer

A power hammer arranged for motor drive, built by Beaudry & Co., Inc., Boston, is shown in the accompanying illustration. These hammers now can be furnished equipped with Westinghouse alternating or direct current motors, which provide a compact drive and can be used to advantage in plants where overhead shafting is not employed or where the blacksmith shop is isolated and located at a distance from the main power plant. Seven sizes of hammers are built by the Beaudry company and these are driven respectively by two, three and five-horsepower motors operated at from 900 to 850 revolutions per minute. The weight of ram of the seven sizes built follows: 25, 50, 75, 100, 125, 150 and 200 pounds.

Michigan Active in Mining

Michigan holds sixth place among the states in the value of its mineral production, with an output in 1912 valued at $80,062,486, according to the United States Geological Survey, its prominence being due to its great wealth in copper and iron. Ranking second only to Minnesota in the production of iron ore, it is third in the production of copper, being exceeded only by Arizona and Montana. It also ranks first in the production of salt, bromine, calcium chloride, graphite, and sand-lime brick.

In 1911 Michigan's production of iron ore was 8,945,103 long tons, valued at $23,810,710, and in 1912 it increased to 12,717,468 long tons, valued at $29,003,163.

The production of copper in Michigan, the value of which in the last two years has exceeded that of the output of iron ore, amounted in 1912 to 218,138,408 pounds, valued at $135,992,837, a decrease in quantity, but an increase in value of over $8,000,000. The value of the copper produced was 45 per cent of the value of the state's total mineral output, and the quantity produced was 17 per cent of the total for the United States.

Copper Mining by Indians

The mining of copper in Michigan is of prehistoric origin, the metal having been used by the North American Indians before the advent of the white man. The records since 1810,

or for a little more than 100 years, show that the total production of copper in Michigan from that date to the close of 1912 has amounted to over 5,200,000,000 pounds, about 30 per cent of the total output of the United States.

Michigan stands well up among the states in the manufacture of cement, which is third in value among the state's mineral industries. The marketed production in 1912 was about 35,000 barrels less than the production in 1911, but the value showed a slight increase, from $3,024,676 to $3,145,001.

The production of coal in Michigan has shown a declining tendency during the last five years because of the competition of fuel of higher grade from Pennsylvania and West Virginia. In 1912 the production amounted to 1,206,230 tons. There are two plants of by-product coke ovens in Michigan, one at Detroit and the other at Wyandotte, but the coal for both of these plants is obtained from mines in West Virginia. The total value of the mineral products in Michigan in 1912 was $80,062,486, against $65,275,324 in 1911.

Year of Profits in Pittsburgh District

(*Continued from Page 12*)

At the opening of 1913, both plates and shapes, for forward shipment, were quoted at 1.45c, minimum. Some mills asked 1.50c and 1.55c, and material for prompt delivery commanded premiums ranging from $4 to $8 a ton. Mills entered the new year under the most auspicious conditions; they had sold outputs for six and nine months ahead, and none of them was soliciting additional tonnages. Railroads played an active part in the market the first two months. The most important question with manufacturers was that of deliveries.

Shipments did not improve until May 1, at which time premiums began to disappear; by the end of that month both plates and shapes were obtainable at a range from 1.45c to 1.50c for any delivery. Specifications against contracts fell off considerably during July and August, and some mills were in a position to offer quick deliveries; a few of the smaller mills were quietly taking orders for plates at 1.40c. In September, plates and shapes were listed at a range from 1.40c to 1.45c. Plates continued to weaken, and, at the end of October, were quoted at a spread between 1.30c and 1.35c; shapes were holding more firmly—they could not be obtained at less than 1.35c. Both products declined $1 a ton in November.

Early in December, the market for both materials fell to 1.25c, and shapes were held fairly well to that figure the remainder of the year. Plates continued to display irregularity; they declined to 1.20c the second week in December, and were held at that level by many manufacturers. Some tonnage, however, was obtained at 1.15c, which represents the bottom of the market over a period of 24 months.

The Carnegie Steel Co., in February, received an order for 15,000 tons of plates for the United States battleship Pennsylvania, and the Cambria Steel Co., the same month, received a contract from the Newport News Ship Building & Dry Dock Co. for 15,000 tons of plates for the Ohio Connecting Bridge, Sheridan, Pa., involving about 14,000 tons; the McClintic-Marshall Co. was awarded the contract for the Kaufmann-Baer store, Pittsburgh, 8,000 tons, and numerous other orders, involving attractive tonnages, were placed in this district.

Merchant Bars

Steel bar makers entered the year under most favorable conditions; many of them had sold their entire outputs through the first nine months, and the market was not broken until November. During the last two months of 1913, bar steel prices declined about $4 a ton, but manufacturers refused to sell for more than three months' shipment.

At the opening of the year, steel bars were listed at 1.40c, for forward shipment, and that figure was firmly held until about Nov. 1, despite irregularity displayed by both plates and shapes previous to that date. During November, however, prices declined $2 a ton, and two reductions of $1 each were recorded the first two weeks of December. The market did not reach the low level that prevailed the early part of 1912—1.15c.

Naturally the market during the first six months of the year was decidedly quiet, with reference to new buying, inasmuch as heaviest consumers were under cover. Agricultural implement manufacturers covered requirements the latter part of April, and most of them paid full prices for 1913-14 material, booking on long-term contracts. Some mills refused to sell for shipment after Jan. 1, but implement makers had no trouble in obtaining desired tonnages through other sources.

Bar iron was held at 1.70c, minimum, until the latter part of June, when it declined $1 a ton. Declines of $1 a ton each were registered in July, August, September, October, November and December. At the end of the year, bar iron was weak at 1.40c.

Bar iron prices did not affect bar steel quotations in this district as they did in other territories, particularly the west.

A study of the rise and fall in the prices of billets and sheet bars in 1913 gives the student of the iron and steel trade an accurate account of the general trend of market conditions in the year just ended. Prices were relatively high at the beginning of the year; they continued to advance for several weeks, remained stationary until the early part of May, declined slightly, held their own for a while and then steadily decreased, until, at the end of the year, both products were selling at $9 a ton less than the highest levels established during the 12-month period. The low levels which prevailed the early part of 1912, however, were not reached. In that year billets sold as low as $19 and $19.50.

At the opening of 1913, Bessemer and open-hearth products sold at the regular price differentials that prevailed in 1912, but before the end of the year manufacturers made no grade distinction in quoting prices. The first week in January, prices were as follows: Bessemer billets, $27.50; Bessemer sheet bars, $28; open-hearth billets, $28; open-hearth sheet bars, $28.50, maker's mill, either Pittsburgh or Youngstown. It also is interesting to note that quotations the latter part of the year were based at "maker's mill", irrespective of location. Before the end of the first month, all four products advanced $1 a ton, the result, primarily, of a rather acute shortage, which threw the United States Steel Corporation into the market several times for large tonnages. Prices continued to climb, and were 50 cents a ton higher at the end of February than at the beginning of that month. In March and April quotations were stationary, with Bessemer billets commanding $29, open-hearth billets, $29.50, Bessemer sheet bars, $29.50, and open-hearth sheet bars $30.

New capacity open-hearth steel began to show its effect upon the mar-

ket early in May. The Youngstown Sheet & Tube Co., which completed six 100-ton open-hearth steel furnaces, offered sheet bars, for forward shipment, at $27.50, Youngstown, and quotations for immediate delivery soon were decreased $1 a ton by other makers. By the end of May, billets were listed at $27 and sheet bars at $27.50, for either delivery. Early in June, billets declined to $26.50, but sheet bars remained at $27.50. Those figures represented the market in June and July, during which time the Carnegie Steel Co., the Youngstown Sheet & Tube Co., the Republic Iron & Steel Co., and other prominent manufacturers sold a large portion of their outputs for the second half of the year.

In August, some of the smaller makers of open-hearth steel products accumulated small surpluses, and offered sheet bars to an important consumer in the Pittsburgh district at an attractive concession. The offers, of course, were accepted, and the $27.50 price of sheet bars became a thing of the past. At the beginning of September, billets were listed at $25 and sheet bars at $26; a month later prices were $1 a ton lower.

Prices steadily declined during October and November. On Oct. 9, billets commanded $23 and sheet bars $24; at the end of that month billets were listed at $22 and sheet bars at $22.50. Billets dropped 50 cents a ton in November; sheet bars declined $1 a ton.

Open-hearth steel capacity in the Pittsburgh district was increased greatly during the year. The Youngstown Sheet & Tube Co. completed its six 100-ton open-hearth furnaces; the Carnegie Steel Co., at Braddock, completed 14 75-ton open-hearth furnaces; the Brier Hill Steel Co.'s open-hearth plant, consisting of a battery of seven 75-ton furnaces, was completed and the Pittsburgh Crucible Steel Co. started to operate eight new 75-ton furnaces at Midland, Pa.

Sheets

Despite low quotations that appeared the latter part of the year, manufacturers of steel sheets enjoyed a successful season in 1913. During the first part of the year, mills were handicapped considerably because of the scarcity of raw material, and unprecedented floods and high waters in March cut down production to a great extent at a time when consumers were particularly anxious to obtain material. Prices, comparatively speaking, were high, tables maintained by THE IRON TRADE REVIEW showing that the low levels of 1912 were not touched, while the highest prices of that year were exceeded by $2 a ton.

But the trend of the market in 1913 was directly opposite to that of the preceding year. In 1912, prices steadily advanced; in 1913 they continued to advance for a couple of months and then gradually decreased, until, at the end of the year products were selling from $8 to $13 a ton lower than the highest prices commanded during the 12-month period.

In 1912, blue annealed sheets advanced $6 a ton; in 1913 they declined $8 a ton; black sheets, in 1912, advanced $10 a ton and declined $10 a ton in 1913. Galvanized sheets in 1912 advanced $12 a ton and decreased $13 a ton the year just ended. The following table shows the trend of the market in 1913:

	Gage.	Low.	High.	Range per ton.
Blue annealed....	10	1.35c	1.75c	$ 8
Black	28	1.85c	2.35c	10
Galvanized	28	2.85c	3.50c	13

Nineteen hundred and thirteen opened with blue annealed sheets listed at 1.65c, black sheets at 2.25c and galvanized at 3.40c, for base size gages, with many of the independent manufacturers asking $2 a ton above those figures. On Jan. 13, the American Sheet & Tin Plate Co. advanced all three products $2 a ton, and the low levels were immediately adopted by all makers. The last previous formal increase was Oct. 10, 1912, when a general advance of $2 a ton was announced. In January and February, the leading interest, as well as independent manufacturers of steel sheets, broke all previous records from the standpoint of specifications. In March, the Apollo Steel Co., which completed a six-mill plant at Apollo, Pa., started to figure in the market, soliciting orders for forward shipment.

The market remained strong until the latter part of March, when lower prices cropped out along the Ohio river, and quotations for galvanized sheet products were reduced $2 a ton before May 1, and concessions were beginning to appear for black sheets. The market continued irregular in May and June, and specifications were falling off. At the beginning of the second half, quotations were as follows: Black, 2.25c; galvanized, 3.35c to 3.50c; blue annealed, 1.75c for base size gages. By the end of July galvanized and blue annealed sheet products declined $1 a ton. Quotations were lowered another $1 a ton the second week in August, and a similar decline featured the market the end of that month. At the close of September, blue annealed products were listed at 1.60c, black at 2.10c and galvanized at 3.10c, for base sizes. A $2 a ton decline characterized the market in October, and quotations fell off $1 a ton in November. Prices continued to decline in December. Specifications in November and December showed considerable improvement over those of the preceding five or six months.

Sheet makers, as previously pointed out, enjoyed relatively high prices in 1913. But, cost of operation was increased greatly by the high price

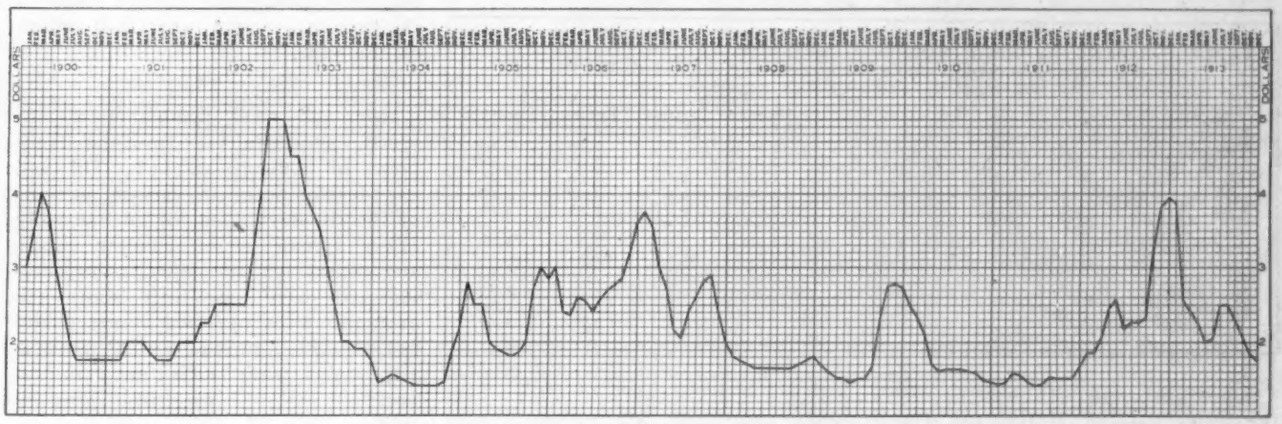


CHART GRAPHICALLY SHOWING FLUCTUATION OF COKE PRICES IN 14 YEARS.

of raw materials, particularly sheet bars and spelter. Additional capacity the second half of the year showed its effects upon the market, but lower prices were inevitable.

Tin plate manufacturers enjoyed a good year. Material for the 1913 season was sold before Jan. 1, and the $3.60 base price, announced the latter part of 1912 by an independent manufacturer in the Pittsburgh district, was well maintained. The more prominent tin can makers, however, were able to shade the formal price in a great many instances.

Mills entered the year under excellent conditions. Practically every serviceable mill in the country was operating at maximum capacity, and production would have been heavier had it not been for the scarcity of raw material during the first quarter. Specifications against contracts came out at a phenomenal rate during January and February, and mills were driven at full speed until the high waters and floods, which swept over western Pennsylvania and the central states the latter part of March, put plants out of commission.

TABLE SHOWING AVERAGE MONTHLY MINIMUM PRICES CONNELLSVILLE FURNACE AND FOUNDRY COKE PER TON AT THE OVENS IN 1913

Month.	Furnace. Prompt.	Furnace. Contract.	Foundry. Prompt.	Foundry. Contract.
January	$3.88	$3.25	$4.45	$4.00
February	2.56	2.75	3.69	3.69
March	2.41	2.50	3.50	3.50
April	2.25	2.50	3.06	3.19
May	2.00	2.45	2.89	3.00
June	2.04	2.25	2.85	3.00
July	2.50	2.50	2.85	3.00
August	2.50	2.50	2.85	3.00
September	2.31	2.44	2.85	3.00
October	2.07	2.15	2.76	2.81
November	1.84	1.92	2.50	2.50
December	1.71	1.80	2.50	2.50
Average	2.34	2.42	3.06	3.09

Inability of domestic manufacturers to fill orders for prompt delivery was clearly demonstrated in April, when the Standard Oil Co. was forced to enter the Welsh market for 75,000 boxes of tin plate for early shipment. In May and June, the market was quiet, with reference to new buying, but specifications continued to come out liberally. In September, mills in need of additional tonnage offered material at $3.55, for base size boxes, and the market for prompt shipment declined to $3.50 before the season's price for 1914 was announced, Nov. 3, by the American Sheet & Tin Plate Co. The new price, $3.40, was $4 a ton less than the price for the 1913 season. At the time of its adoption it was low enough to prevent importations, and, at the time of writing this report there was no indication of a foreign invasion. Before the end of the year, practically all the important tin plate consumers had covered 1914 requirements, and the $3.40 price was maintained with very few exceptions.

Wire

Were it not for the slump in prices the latter part of the year, the 1913 wire market would be called fairly satisfactory. During the first quarter, conditions were decidedly active, and prices relatively high; specifications fell off slightly in the second quarter, but prices did not begin to weaken until shortly before the opening of the second half. Conditions were quiet during the last six months of the year, but historic low prices were not touched. Prices in 1913 compared favorably with those of the preceding year; in 1912, wire nails registered an advance from $1.55 to $1.75 a keg; in 1913, the high level for nails was $1.80 and the low level was $1.55 a keg, although in some territories nails sold at $1.50 the last month of the year.

The $1.50 base price for nails prevailed the latter part of 1911. That figure represents the bottom of the market during the last 14 years. Nails declined to $1.15 the latter part of 1898, and sold at a spread from $1.15 to $1.45 until Feb. 24, 1899, when quotations were advanced $1 a ton. Prices steadily advanced that year, and nails were commanding $3.20 a keg before the end of 1899.

At the beginning of 1913, nails were listed at $1.75 and plain wire at $1.55. On Jan. 14, the American Steel & Wire Co. increased extras for coppered and liquid finished wire products 10 cents per 100 pounds; this advance was in harmony with a similar advance affecting galvanizing extras, announced Oct. 12, 1912. During January and February, the wire market was practically the only department that reflected strength. Specifying was extremely heavy; but new buying was light. To stimulate business, prices were advanced $1 a ton March 22, and the leading interest adopted new prices a couple of days later. Difficulty was experienced in establishing higher levels, and it was not until the end of April that tonnage was sold at the prevailing prices. No formal changes in prices were made in the second quarter, although some interests were selling material at $2 a ton below the nominal market.

The market, at the beginning of the third quarter, was on the basis of $1.70 for nails and $1.50 for plain wire, although some of the leading manufacturers were attempting to maintain prices $2 a ton above those figures. In August, wire products declined $1 a ton, and the market was stationary until the middle of September, when another $1 decline was recorded. The latter part of November nails declined to $1.55 and plain wire to $1.35. During December, prices were maintained fairly well, although concessions appeared in some sections of the country.

Mills operated at practically maximum capacity the first six months of 1913; outputs were reduced somewhat the third quarter, and production was not above 50 per cent of theoretical capacity the last month of the year.

Pipe

Iron and steel manufacturers enjoyed a successful year from the standpoint of tonnage shipped. Oil and gas developments in various sections of the country called for an unusually heavy volume of oil country goods, and orders for line pipe, tubing, casing and drive pipe were above the average. Mills operated at practically full capacity during the 12 months just ended, and leading makers expect to enjoy a successful year in 1914.

Steel pipe discounts were relatively low all year. The bulk of the tonnage was sold at prices in effect Jan. 2, despite the fact that both butt weld and lap weld sizes were advanced a couple of times. Furthermore, consumers benefited from greater preferential discounts, which some manufacturers offered when books were opened last January. Iron pipe discounts, the first five months of 1913 were the same as those announced by leading makers Oct. 21, 1912. On June 2, 1913, standard iron pipe was advanced $2 a ton; there has been no formal change in price since that time.

The new standard of weights and list prices, first adopted by the National Tube Co., which were explained in the Annual Statistical number of THE IRON TRADE REVIEW a year ago, went into general effect Jan. 1, having been accepted by all manufacturers of steel pipe.

Prices provided by cards issued un-

der date of Jan. 2, 1913, were maintained until April 12, when the leading interest advanced standard steel pipe ½ point or $1 a ton; another $1 advance became effective May 27. On Aug. 8, butt weld sizes, which had displayed irregularity, were subjected to a $2 decrease in price by the National Tube Co., and lap weld sizes were reduced $2 a ton Oct. 27. Discounts after that date were the same as those prevailing the beginning of the year. The National Tube Co. adopted a preferential discount of 5 and 2½ per cent Oct. 27, as against the previous preferential discount of 5 per cent, giving consumers the advantage of a reduction equivalent to about $1 a ton. The additional discount had been offered by some mills earlier in the year.

Orders included a number of attractive tonnages, although no particularly large orders were placed. Early in the year, the Philadelphia Company bought 8,500 tons of iron oil country goods for West Virginia shipment; the Hope Engineering Co., at about the same time, purchased 75 miles of 12-inch and 80 miles of 10-inch steel pipe for Canadian shipment; in March, an order for 190 miles of 10-inch and 160 miles of 16 and 18-inch pipe for Ohio shipment was placed with Pittsburgh mills, and several other large orders were distributed among manufacturers in this district.

Old Material

The scrap market always has been regarded as an accurate index to the general iron and steel situation; this department has broken no traditions the last 14 months. As early as November, 1912, when orders for finished products were unusually heavy, the market for old materials was hit by a decided slump, and the more important grades have not yet reflected any signs of recovery. Prices were falling off in December, but dealers appeared more optimistic than they had been for over a year.

At the beginning of the year just ended, heavy melting steel was listed at $15 and malleable at $14, delivered in the Pittsburgh district. Tables maintained by THE IRON TRADE REVIEW show that heavy melting steel declined $4.25, and malleable fell off $3.50 a ton during the year.

Heavy melting steel declined to $14.25 in February, and other grades were correspondingly weak. Machine shop turnings, listed at $10 a ton the early part of February, were selling at $9 a ton the end of that month. Several grades reflected slight strength in March, but prices began to soften in April, and by the end of the first half, heavy melting steel was being offered at $12.50. That figure represented the market until the third week in October, when a 25-cent decline was registered. Early in November, best grades of heavy melting steel were offered at $11.75, and some consumers refused to pay $10.50 the latter part of December.

Labor Conditions

Nineteen hundred and thirteen was not so free from labor troubles as 1912. Several strikes, some of which were featured by violence, were called during the first half of the year, in an attempt to organize men in some of the larger mills. Open shop policies, adopted by owners of numerous mills in which union puddlers had been employed, resulted in the closing of a few sheet and tin plate plants, and the puddling departments of some of the more prominent iron manufacturers were down several months, as a result of refusals to sign wage scales.

The Amalgamated Association of Iron, Steel and Tin Workers was granted a substantial increase in the rate for boiling for the year ending June 30, 1914, and members of that organization received very satisfactory wages during the entire year just ended. Members of this organization employed at the Steubenville, O., plant of the Phillips Sheet & Tin Plate Co. went on strike when owners of the mill refused to sign the scale. The Youngstown Sheet & Tube Co., the A. M Byers Co., and several other important manufacturers refused to meet demands of the United Sons of Vulcan, who asked a flat rate of $7 a ton, and the puddling furnaces in these plants were idle several months. About 10 per cent of the laborers at the Rankin, Pa., plant of the American Steel & Wire Co. went on strike the latter part of January, but returned to work before the end of a fortnight. Numerous other strikes, of short duration, were called, but troubles were amicably settled in practically every instance.

The Carnegie Steel Co., the latter part of January, advanced wages of common laborers from 17½ cents to 20 cents an hour, equivalent to an increase of 25 cents a day. Other manufacturers met the advance, either directly, or by extending working days. When mills began to slow down the last three months of the year, working forces were reduced, and hundreds of men were laid off.

Bi-Monthly Settlements.

	1913.	1912.
Jan.-Feb.	1.4831c	1.187c
Mar.-Apr.	1.5434c	1.195c
May-June	1.5272c	1.2183c
July-Aug.	1.5029c	1.2518c
Sep.-Oct.	1.3c	1.3351c
Nov.-Dec.	.....	1.40c
Year's average	.....	1.2645c

Annual Average of Settlements.

For year 1912	1.2645c
For year 1911	1.2598c
For year 1910	1.4423c
For year 1909	1.360c
For year 1908	1.386c
For year 1907	1.627c
For year 1906	1.587c

The accompanying table indicates the bi-monthly settlements, affecting the Amalgamated Association of Iron, Steel and Tin Workers; the settlement for September and October, showing a realized price on bar iron slightly above 1.35c, provided a puddling rate of $6.40 a ton for November and December, as against the $7 rate obtained in September and October.

TABLE SHOWING QUOTATIONS ON COKE FOR PROMPT DELIVERY AT OVENS IN THE CONNELLSVILLE REGIONS

	Furnace				Foundry			
	1910	1911	1912	1913	1910	1911	1912	1913
January	$2.48	$1.41	$1.84	$3.88	$3.03	$1.97	$2.05	$4.45
February	2.33	1.44	1.85	2.56	2.95	1.95	2.22	3.69
March	2.10	1.58	2.06	2.41	2.77	2.00	2.65	3.50
April	1.70	1.55	2.44	2.25	2.54	1.99	2.75	3.06
May	1.60	1.44	2.57	2.00	2.29	1.90	2.62	2.89
June	1.63	1.40	2.17	2.04	2.21	1.77	2.56	2.85
July	1.63	1.42	2.25	2.50	2.10	1.80	2.46	2.85
August	1.62	1.51	2.25	2.50	2.17	1.85	2.60	2.85
September	1.60	1.50	2.31	2.31	2.13	1.85	2.67	2.85
October	1.59	1.50	3.22	2.07	2.09	1.86	3.35	2.76
November	1.49	1.50	3.82	1.84	2.01	1.89	4.41	2.50
December	1.45	1.64	3.93	1.75	2.00	1.90	4.50	2.50
Average	1.77	1.48	2.55	2.34	2.36	1.89	2.90	3.06

Coke

Nineteen hundred and thirteen was a profitable year for operators of coke oven plants in the Connellsville regions, although dealers experienced considerable trouble in obtaining desired prices through the greater part of the 12-month period. The accompanying line chart, showing the trend of the market since 1904, indicates that prices in 1913 did not reach the high levels established the preceding year, but the bulk of the tonnage shipped in the year just ended netted much better profits than were enjoyed since 1907.

In the first month of 1913, spot furnace coke commanded as high as $4 a ton, and contract blast furnace fuel sold as high as $3.25 a ton at the

ovens. The average price of prompt and contract furnace coke for the year was $2.34 and $2.42, respectively; the average price of prompt and contract foundry fuel was $3.06 and $3.09, respectively.

During the last ten years, furnace coke has sold at a range between $1.40 and $5 a ton at the ovens. The line chart, which includes monthly averages based upon minimum quotations, shows that spot furnace coke sold at $1.40 for several months in 1904, and the $5 mark was established in 1902.

The strength of selling agencies was clearly indicated in the year just ended, when several important sellers declared they would not ship blast furnace coke for less than $2.50. As a result, the market was held at that figure in June, July and August. Operators contended they could not figure in the market at less than that figure and still enjoy profits. Consumers, on the other hand, argued that the price of pig iron did not warrant $2.50 coke, and, instead of covering second half requirements at the customary time, bought fuel from month to month. The $2.50 quotation was not withdrawn until the latter part of the year.

The Downward Trend

Spot furnace coke declined from $4 to $3.50 in January, and was selling at $2.50 the latter part of February. During March and April, furnace coke sold at $2.25, and at $2 a ton in May and June. In the second half, prices declined to $1.70, ovens. For forward shipment, 48-hour coke sold at a range between $2.25 and $3.25, ovens, the first six months, and from $1.80 to $2.50, ovens, the second half.

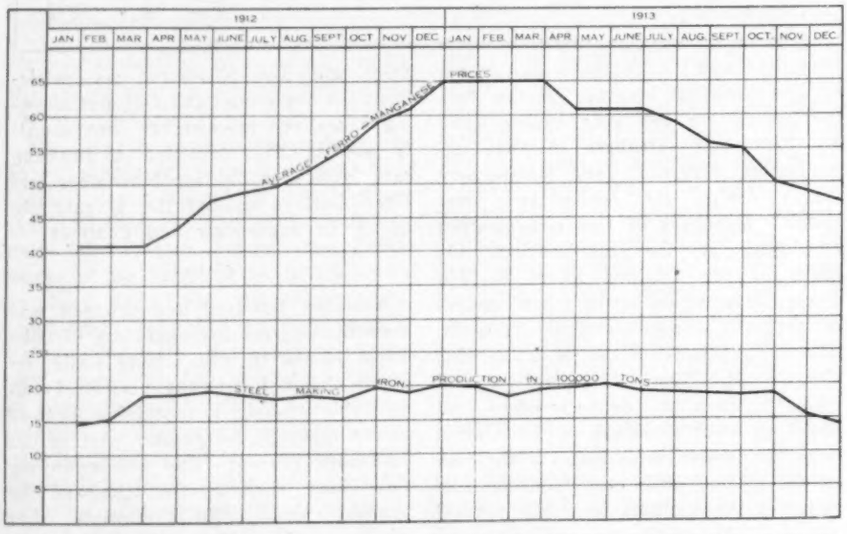
Prompt foundry coke, the first six months, was obtained at a range from $2.85 to $4.50, ovens; during the last six months this grade sold at a spread between $2.50 and $2.85, for spot shipment. Contract foundry coke was listed at a spread between $3 and $4, in the first half and between $2.50 and $3 in the second half of 1913.

Ovens in the upper and lower Connellsville regions were operated at record-breaking capacities until the beginning of July, after which time production was curtailed. The 400,000 ton mark, for weekly production, was passed 21 times the first six months of the year, and only once the last six months, according to figures compiled by the *Connellsville Courier*. Production the first and second quarters aggregated more than 10,600,000 tons in 1913, as against about 10,019,000 tons during the corresponding period in 1912. In 1912, total production was 20,032,075 tons; figures for 1913 will fall below those for the preceding year.

Coke shipments for the upper and lower Connellsville regions since 1907, according to the *Courier*, were as follows: 1907, 19,029,058 tons; 1908, 10,700,022; 1909, 17,785,832; 1910, 18,689,722 tons; 1911, 16,334,174; 1912, 20,000,873 tons.

Trend of Ferro-Manganese Prices in 1913

Standard English ferro-manganese opened the year 1913 with a price of $65, seaboard, the highest value scored by the general market upon this material since 1907. It closed with a quotable price of $47, seaboard, a loss of $18 a ton in the year. This decline in price, however, was virtually $15.50, because of the removal of the former duty of $2.50 and of the free-listing of this material in the new tariff law.



PRICES OF FERRO-MANGANESE AND PRODUCTION OF STEEL-MAKING IRON IN 1912 AND 1913.

The high price of $65 was established following a heavy buying movement at $61, a point to which the market had been gradually raised throughout the year 1912 by the wide activity of the steel industry. In fact, the net advance shown by ferro-manganese in 1912 was $24 a ton. It has been pointed out that ferro-manganese through its price fluctuations affords a true barometer of the steel trade of the world. It is to be noted that when the $65 price was reached, Nov. 29, 1912, the steel industry of the United States was running at an unprecedented rate of production. The output of non-merchant or steel-making pig iron then was around 2,000,000 tons monthly.

Events subsequently proved that the market had been worked out largely at the $61 stage or lower levels and very little material was purchased as high as $65, seaboard. In fact, it is doubtful whether a single forward contract was made at this price. Whatever buying was done was largely of a spot lot and carload class.

As consumers could not be attracted to the market, and as the steel industry began to show signs of slowing down from its high speed, it was apparent that the $65 level could not be held. Accordingly, a reduction to $61, seaboard, was announced on April 1, 1913, followed by others to $58.50, on July 8, to $56, on August 8, and to $52.50 with duty, on Sept. 26. When the tariff bill went into effect, Oct. 3, free-listing ferro-manganese, the price automatically became $50, seaboard. On Dec. 2 a further decline of $3 to $47, seaboard, was announced. With a falling steel market, buying of this alloy continued very sluggish in the clos-

ing months of the year, and further price declines were indicated. German ferro-manganese sold in the year usually at 50 cents to $1 a ton under the English product.

Some flurry was caused in the ferro-manganese market in the year through reports that plans were being shaped by several different interests for the manufacture of this product for sale in this country. Consideration of such enterprises was brought about through the proposal in the Underwood bill passed by the house to make the duty on ferro-manganese 15 per cent ad valorem instead of a former specific duty of $2.50 per ton. Such a change in the duty would have meant, at the price the alloy then was selling, a protection of about $8 a ton. On this basis of duty, it was figured by prospective makers that manganese ore could be imported and ferro-manganese manufactured in this country for sale to

	Average ferro price.	Steel-making iron output.
Jan., 1912	$41.00	1,465,000
Feb., 1912	41.00	1,515,000
Mar., 1912	41.00	1,835,000
Apr., 1912	43.50	1,835,000
May, 1912	47.50	1,925,000
June, 1912	48.00	1,820,000
July, 1912	49.50	1,800,000
Aug., 1912	52.00	1,845,000
Sep., 1912	55.00	1,770,000
Oct., 1912	59.00	1,955,000
Nov., 1912	61.00	1,905,000
Dec., 1912	65.00	2,000,000
Jan., 1913	65.00	1,990,000
Feb., 1913	65.00	1,805,000
Mar., 1913	65.00	1,915,000
Apr., 1913	61.00	1,965,000
May, 1913	61.00	2,000,000
June, 1913	61.00	1,875,000
July, 1913	58.50	1,860,000
Aug., 1913	56.00	1,850,000
Sep., 1913	55.00	1,830,000
Oct., 1913	50.00	1,855,000
Nov., 1913	50.00	1,565,000
Dec., 1913	47.00	*1,400,000

*Estimated.

successfully compete against the price of the foreign product. The suitability of certain blast furnaces in Virginia and eastern Pennsylvania for this line of production was thoroughly inquired into while this plan was under consideration. Independent steel makers put in a sharp protest against such an increase in duty, which would fall wholly upon them, since the United States Steel Corporation manufactures in this country all the ferro-manganese for its own consumption. The senate finally revised the original house measure and placed ferro-manganese upon the free list, where it remained at the subsequent final passage of the bill. The placing of ferro-manganese on the free list immediately killed any proposals for the merchant production of this material in this country.

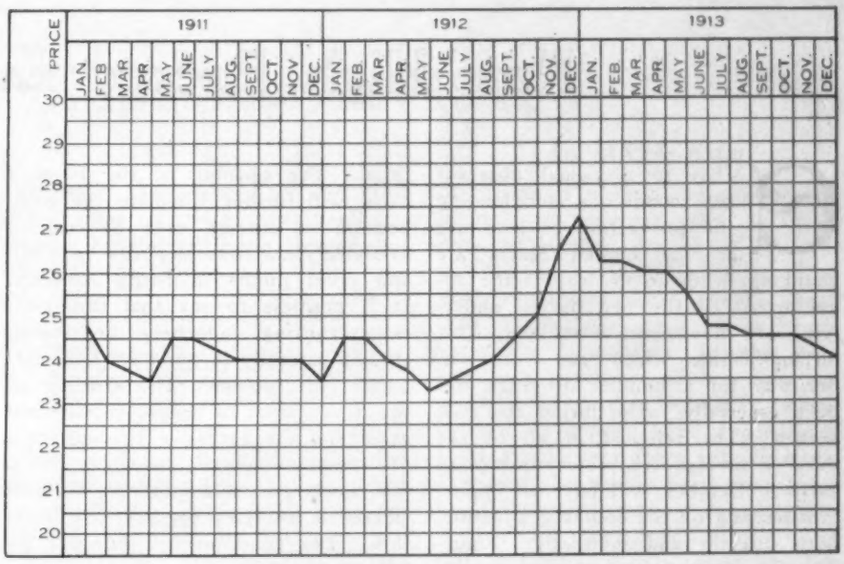
The average prices per month on ferro-manganese at eastern seaboard and the production of steel-making pig iron in the United States during each similar period of time, as compiled from the pig iron statistics gathered from THE IRON TRADE REVIEW are given in the accompanying table. The intimate relation ferro-manganese prices bear to the rate of output of steel-making iron, can be observed from the chart.

The dates upon which official changes in ferro-manganese prices have occurred during the past two years and the quotations at eastern seaboard announced by makers at these times, are as follows:

Jan., 1912 (market)	$41.00
Apr. 15, 1912	43.50
Apr. 27, 1912	46.00
May 10, 1912	48.50
July 24, 1912	51.00
Aug. 23, 1912	53.50
Sep. 9, 1912	56.00
Oct. 7, 1912	61.00
Nov. 29, 1912	65.00
Apr. 1, 1913	61.00
July 8, 1913	58.50
Aug. 8, 1913	56.00
Sep. 26, 1913 (with duty)	52.50
Oct. 3, 1913 (duty free)	50.00
Dec. 2, 1913	47.00

considerable of this being due to the off-season as well as to the general slowing up of business. At that time, eastern pipe makers were operating their shops at about 50 per cent of capacity.

A compilation of average prices for six-inch pipe, delivered in New York City, during the year of 1913, based upon sales made by the Warren Foundry & Machine Co. Phillipsburg, N. J., with offices at 111 Broadway, New York City, has been prepared by David Runkle, of that company, and produced herewith in tabular and charted forms. These prices do not establish the inside competitive levels at which business actually was taken by various makers in the New York district during the year, but they afford a true line upon the general tendency of the market during that period. The actual inside basis for competitive business in the metropolitan district, in 1913, probably



CAST IRON PIPE PRICES FOR THREE YEARS.

Cast Iron Pipe Declined Steadily in 1913

Cast iron pipe prices, delivered at New York City, started the year of 1913 on a favorable plane for makers. This level of prices had been established by the activity in the pipe trade during the previous year that had resulted in the high point of the market being reached in December. In January, 1913, some reaction began to appear in the price situation and from that point throughout the year the market steadily declined, until in December it had fallen about $2.25 below the level at the opening of the year.

At the year's close, business in the eastern pipe trade was very quiet, would be about $1.00 a ton on the average under the prices of the Warren company.

The following table represents a comparison of the average prices for six-inch pipe, 30 pounds per foot weight, delivered in carload lots at New York City during the past three years, as compiled by Mr. Runkle from the sales of his company:

	1913.	1912.	1911.
January	$26.25	$24.50	$24.75
February	26.25	24.50	24.00
March	26.00	24.00	23.75
April	26.00	23.75	23.50
May	25.50	23.25*	24.50
June	24.75	23.50	24.50
July	24.75	23.75	24.25
August	24.50	24.00	24.00
September	24.50	24.50	24.00
October	24.50	25.00	24.00
November	24.25	26.50	24.00
December	24.00‡	27.25**	23.50

*Low. **High. ‡Estimated.

JEAR'S DEVELOPMENTS ON

Pennington mine, operated by the Tod-Stambaugh Co. This

New High Record Established for Lake

EVEN to a casual observer the conditions surrounding the production of iron ore in the United States are changing, while to the expert the development of the new forces underlying ore movements is striking. This metamorphosis, which has been under way for a number of years, has been especially rapid during the past season. The removal of all of the duty on foreign ore, which took place early in October, will have an important bearing on the domestic situation, both directly and indirectly. Figuring an average freight rate of 5 mills per ton-mile, the 15-cent reduction in the tariff makes it possible to ship the imported product about 30 miles farther inland. This, to be sure, is an insignificant distance, but, nevertheless, a vital one in a highly developed iron and steel producing region like central Pennsylvania. The new situation brings foreign ore practically to the eastern gates of Pittsburgh, and it is doubtful if even this great consuming center will continue to be monopolized by the product of the Lake Superior mines. The indirect effect of the new tariff, which throws open the iron and steel markets of America to the manufacturers of all the world, naturally also has an important bearing on the iron ore situation and will result in greatly increased pressure for cheaper raw material. The opening of the Panama canal will further stimulate the competition of foreign ores by making available numerous deposits in Chili and other points in South America. It is needless to say that these various shifting influences are being studied carefully in our own Lake Superior ore regions. The attitude of the government in regard to conservation and the excessive concentration of valuable natural resources in a few hands also is a factor to be considered in studying the iron ore situation. The government's influence already has led to great changes in the distribution of ore holdings and was undoubtedly largely responsible for the cancellation of the Hill lease by the United States Steel Corporation.

Any review of iron mining operations in this country during the past year, to be of value, should interpret the events of the season in their relation to the changing fundamental conditions previously enumerated. An effort to so interpret and correlate the progress of 1913 will be embodied in this article. To treat the subject adequately, it is necessary to consider the shipments from the various mines and ranges; any events which would affect the commercially available supplies of iron ore; the depletion or accretion of ore reserves due to shipments, explorations and new developments; progress and improvements in mining methods which might have a general effect on the cost of production; labor conditions; new avenues of transportation; taxation; price fluctuations and periodic variations in the quality of ores mined and shipped.

Shipments during 1913 broke all previous records and including the all-rail consignments which will go forward during the winter, probably will exceed 50,000,000 tons for the first time in the history of the American iron and steel business. Lake shipments during the season of navigation aggregated 49,070,478 gross tons, an increase over 1912 of 1,634,-701 tons. The increase amounts to practically 3½ per cent. These figures are of importance as a measure of the great demand for steel products during the major portion of the past year and as an indication of the ability of the mining organizations to meet practically any reasonable demand for ore tonnage. In fact, as far as the mining end of the business is concerned, no great effort was required to ship over 49,000,000 tons down the lakes in less than eight months. The significant thing is not that this great amount of ore was forwarded, but that 60,000,000 tons could have been delivered to the docks if necessary. The strain told hardest on the steamship lines, but this was due to a considerable extent to bad

is the first open pit to ship ore from the Cuyuna range

Superior Iron Ore Shipments in 1913

By H Cole Estep

weather during the fall which delayed the ore fleet materially. Had it not been for the great storm in November, the lake shipments might have exceeded 50,000,000 tons.

The ranges in Minnesota shipped 36,195,183 tons, of which 33,788,617 tons were furnished by the Mesabi range, 1,662,918 tons by the Vermillion range and 743,648 tons by the Cuyuna range. Minnesota shipments, it will be noted, constituted over 72 per cent of the total ore movement, and the Mesabi range alone furnished nearly 67½ per cent. The relative importance of Mesabi range shipments shows a slight increase compared with 1912, when this district furnished 66.46 per cent of the total. Also, Cuyuna range shipments show an increase from 0.63 to 1.48 per cent. The rapid development of the Cuyuna range is reflected in these figures and undoubtedly 1914 shipments will show further growth, in spite of the prospect at present for diminished demand for ore.

The Hibbing district, as usual, was the most prolific, forwarding over 11,000,000 tons, or practically one-third of the total Mesabi range production. The Hull-Rust, Mahoning and Susquehanna pits at Hibbing were the largest individual producers. The Susquehanna shipped over 1,000,000 tons, the Mahoning over 2,000,000 tons and the Hull-Rust nearly 3,500,000 tons. The record of the Hull-Rust mine is truly remarkable, as shown by the following figures covering the past seven years:

1907	3,271,214
1908	3,316,782
1909	3,039,911
1910	3,189,975
1911	496,977
1912	2,232,112
1913	3,457,608
	19,004,579

The Oliver Iron Mining Co. had no difficulty in keeping up-to-date with its shipments on the Hill lease, although the minimum this year was 5,250,000 tons. Shipments from the principal Hill properties were as follows:

Fay	296,059
Leonard	1,253,479
Mississippi	122,984
North Uno	381,847
South Uno	1,202,454
Dale	621,540
Mace	141,242
Harold	92,060
Hill	846,663
North Star	278,647
	5,236,975

Superior holds the port record for shipments in 1913, the total being 13,788,343. Of this the Great Northern railway furnished by far the largest amount, namely, 13,060,811 gross tons. The latter is 729,685 tons in excess of the ore handled by the Duluth, Missabe & Northern, which amounted to 12,331,126 tons.

The question of the tonnage of ore that is commercially available is a vital one and the distribution of its ownership is no less important. Ore bodies are commercially available only when they are sufficiently developed so that shipments may be made on demand. It is readily seen that this subject may be of more immediate importance to the consumer or purchaser of ore than the question of reserve tonnages, which it might be impossible to ship without development work for a year or more. The past season has been remarkable for the development of large bodies of ore for the open market, and this has resulted in a great shifting in the distribution of holdings. At the same time, the various steel companies which own their own mines, including the leading interest, have been busy opening up new properties. In consequence of this activity, the iron and steel trade enters the year 1914 with more ore available than at any other time in the history of the industry.

The Oliver Iron Mining Co. has been particularly active in establishing new mines in order to replace the capacity which will be relinquished with the termination of the Hill lease, Dec. 31, 1914. In practically every district, some new development is under way and no less than 10 new properties are being opened. In the Adams district initial shipments were made from the Graham and Vivian, two new underground mines near Bi-

wabik. The completion of the underground workings of the Leonidas mine at Eveleth is a matter of considerable importance since this property probably will become the greatest underground mine in Minnesota. The ore body contains at least 15,000,000 tons or more. The shaft is over 400 feet deep, steel and concrete-lined and the main haulage ways are double-tracked. A large pumping station with a capacity of 4,400 gallons per minute has been established underground and all of the construction is of a most permanent character. In the Eveleth district, the Oliver Iron velopment work has been commenced on the Prindell property and it is the intention of the Oliver Iron Mining Co. also to open a mine on section 13, near Kinross at an early date. At Hibbing, a shaft is being sunk on the Philben property, leased from the state of Minnesota. The surface rights include 80 acres and the ore body contains about 3,500,000 tons. It is a continuation of the Susquehanna formation, which is being developed as an open pit by the Rogers-Brown Ore Co. The Philben shaft, which will be concrete with three compartments, will be about 200 feet in depth. Pittsburgh concern. The land lies between Lake Pokegama and the Mississippi river. Unofficially it is stated that not less than 30,000,000 tons of ore have been proved up, although a great proportion of it must be concentrated by washing.

On the Cuyuna range, the independent steel companies have also been more than usually busy. The Rowe mine of the Pittsburgh Steel Ore Co. has been stripped by hydraulic methods and will be in a position to ship about 700,000 tons in 1914. The Jones & Laughlin Steel Co. is check drilling the Northern Pacific

THE LARGEST IRON MINE IN THE WORLD—A SECTION OF THE HULL-RUST PIT. THIS GREAT PROPERTY AT HIBBING, MINN., TOTAL SHIPMENTS FROM ALL THE

Mining Co. is sinking a shaft on the Minnewas property, southeast of Virginia. This shaft will be 175 feet deep with three compartments, including two skipways and a ladder road. In the Virginia district, the development of the Sullivan mine has proceeded to a point where some ore may be shipped next year. In the same district, a new three-compartment shaft, 150 feet deep, is being sunk at the Wanless mine, 12 miles west of Virginia. Two miles northwest of Virginia, de-

At Chisholm, another underground property known as the Duncan is being developed on section 27. It contains about 6,000,000 tons and the shaft will be 200 feet deep.

The independent companies have been scarcely less active and the explorations carried on by the Jones & Laughlin Steel Co. on the extreme western end of the Messabi range, near Grand Rapids, are of special importance. Eleven tracts comprising 440 acres are under option to the lease near Deerwood. The Inland Steel Co. has decided to materially increase the capacity of the Thompson mine just north of Crosby, by stripping the south ore body. At the present time, the pit is approximately 2,000 feet long, 250 feet wide and 50 feet deep at the western end. Like other Cuyuna range properties, the stripping is unusually easy, consisting of sand and fine gravel, free from boulders.

On all ranges the development of

new mines which will sell ore in the open market has been phenomenal. On the Cuyuna range, undoubtedly the most interesting work was that done by The Tod-Stambaugh Co. at the Pennington mine, near Ironton. This property is being developed into the largest open pit on the Cuyuna range. It shipped over 100,000 tons during the past season, and will be able to ship about 750,000 tons in 1914. Stripping work will proceed throughout the winter. The pit is in the form of a half moon and about 100,000 square feet of the ore body has been exposed at the southern end.

OPERATED BY THE OLIVER IRON MINING CO., SHIPPED 3,457,608 GROSS TONS IN 1913. THIS IS NEARLY 10 PER CENT OF THE MINNESOTA RANGES DURING THE PAST SEASON

The average depth of the overburden is from 60 to 80 feet. The pit is drained by a surface pump placed at the lowest point. Cuyuna range operators, so far, have not found it necessary to construct drainage laterals under the pits.

Other interesting developments on the Cuyuna range include the underground mines of the Cuyuna-Mille Lacs Mining Co., Cuyuna-Duluth Iron Co., M. A. Hanna & Co., Brainerd-Cuyuna Mining Co., Iron Mountain Mining Co., Duluth-Brainerd Co., Cuyler Adams, Cuyuna Iron Valley Mining Co., Cuyuna Iron & Manganese Ore Co., and the Messabi-Cuyuna Iron Land Co. The Cuyuna-Mille Lacs and the Cuyuna-Duluth interests are developing two mines near the Rogers-Brown Ore Co.'s Armour No. 2 property, and they shipped an aggregate of about 30,000 tons last year. M. A. Hanna & Co. have vigorously prosecuted the development of the Barrows mine near Brainerd, and this shaft will be a large producer in 1914. The Brainerd-Cuyuna shaft, which is within the city limits of Brainerd, is down to a depth of 50 feet, and will be driven 106 feet to ledge. The Iron Mountain Mining Co. is practically ready to ship from its property north of Crosby. The Duluth-Brainerd Co. is sinking a shaft west of Crosby. Cuyler Adams expects to ship from the Adams mine on the south range in 1914. The Cuyuna Iron Valley Mining Co., the Cuyuna Iron & Manganese Ore Co. and the Messabi-Cuyuna Iron Land Co. are conducting exploration operations at various points on the range. At present the ultimate development of these properties is problematical.

In addition to the operations of the Great Northern Ore Trustees, which are of paramount importance, two large new independent developments for the open market are in progress on the Mesabi range. This includes the work of the Kewatin Mining Co., near Hibbing, and Butler Brothers, at Nashwauk. The former corporation was organized by the Longyear & Bennett interests, who leased a quarter section, containing about 20,000,000 tons, from the Great Northern Ore trustees. The new property is known as the Bennett mine, and is situated in the neighborhood of the St. Paul pit. A contract for stripping a portion of the tract is being executed by Butler Brothers. This calls for the removal of 1,700,000 yards of material. A large part of the ore body, however, is so deeply covered by overburden that it must be mined underground and the Kewatin company is sinking a vertical, three-compartment shaft to a depth of 300 feet.

The fee control of the mine being developed by Butler Brothers at Nashwauk is also vested in the Great Northern Ore trustees. The St. Paul contractors have leased several sections southwest of the village, which are said to contain about 15,000,000 tons of wash ore. This property is now being stripped and Butler Brothers are arranging for the construction of a concentrating plant on one of the near-by lakes.

It is readily seen from the foregoing that stupendous increases are being made in the tonnage of ore that must be sold on the open market. But the developments that have already been pointed out are of minor importance compared with the plans of the Great Northern Ore trustees. The policy of the trustees in regard to their vast holdings has been an object of considerable conjecture, but it can now be officially stated that the Great Northern ore will be mined by the trustees and sold in the open market. The trustees will have only about 500,000 tons available for shipment in 1914, and, owing to the prevailing uncertainties in the iron trade, it is probable that little effort will be made to dispose of this ore. Arrangements, however, will be made for the sale of a very large tonnage in 1915, aggregating probably 12,000,000 tons. This will include ore from the properties which will revert to the Great Northern interests at the termination of the Hill lease, and also from several new mines that are now being developed.

As is well known, the so-called "Hill Ore Lands" extend from the eastern to the western extremities of the Mesabi range, and are concentrated in the vicinity of Hibbing and Nashwauk. They include a total of some 59 mining properties, and it is estimated that the total ore tonnage exceeds 430,000,000. The larger portion of these properties was leased to the Great Western Mining Co., a subsidiary of the United States Steel Corporation, in August, 1907. Approximately 39,295 acres were involved, containing, it is estimated, 327,394,778 tons. About 44,450,000 tons of this is classified as wash ore. The lease provides for the mining and shipment of a minimum of 5,250,000 tons during 1913 and 6,000,000 tons during 1914. The 1913 allotment has been mined, and undoubtedly the Steel Corporation will extract the full minimum next year. In 1913 the royalty for ore containing 59 per cent iron, under the lease is $1.854. This royalty includes the cost of handling and delivery, sorting, rail transportation and dockage, aggregating 60 cents per ton.

The development and operation of the Great Northern properties, including both the new mines and those that will be turned over by the Steel Corporation, have been entrusted to the Arthur Iron Mining Co. This concern is now opening up four new mines on the Mesabi range, including the Dunwoody, near Chisholm, the Dean mine, at Buhl, the Smith, at Hibbing, and the Hill Annex, near Coleraine. At the Hill Annex only a shaft is being sunk, but at the other three properties stripping is in progress. The largest of the four new mines is the Dunwoody, which contains an aggregate of 28,123,445 tons of iron ore, as estimated by the Minnesota tax commission. The ore body is an extension of that in the Monroe pit, operated by the Oliver Iron Mining Co. The Winston-Dear Co. has the initial stripping contract which aggregates about 6,000,000 cubic yards. The Arthur Iron Mining Co. expects to strip an additional 2,500,000 yards

SHENANGO MINE NEAR HIBBING. THIS IS ONE OF THE MOST PROMINENT INDEPENDENT

with its own organization during the next two winters. The Smith mine, at Hibbing, is now ready to ship ore. The shaft sinking operations at the Hill Annex are only preliminary, and are for the purpose of establishing drainage laterals under the ore body, which will later be mined by open pit methods. The Hill Annex contains probably 40,000,000 tons of wash ore. To take care of this great tonnage, the Arthur Iron Mining Co. is planning on the early construction of a washing plant, having two or three units, with a daily capacity of 2,000 tons of crude ore each.

The Great Northern trustees do not expect to develop any other new properties in the near future. During the coming year, considerable work must be done in perfecting an operating organization to take charge of the mines that will be turned over by the Steel Corporation. In general, it may be said that the open pit properties included in the Hill lease will be nearly worked out before they are relinquished by the Oliver Iron Mining Co. It will, therefore, probably be necessary for the Arthur Iron Mining Co. to continue work in these pits by milling, scramming or underground methods. Of course, further developments of the individual mines will depend on future conditions.

Although the Minnesota ranges shipped over 36,000,000 tons last year, it is probable that the reserves were not depleted, due to the discovery of new ore bodies, particularly on the Cuyuna range. The Vermillion range recently has added very little to the reserve total and the same may be said of the Mesabi range. The latter now is thoroughly drilled and prospected, and large new developments can hardly be looked for. The Oliver Iron Mining Co. discovered a considerable tonnage in the Fayal district by drilling on No. 1 lease, located east of Eveleth. Cuyuna range developments were specially important and a large volume of new ore was discovered. Much of the vertical drilling which was done on the Cuyuna range in the earlier stages of its development was misleading, owing to the dip of the ore formation, which is almost uniformly 45 to 85 degrees to the southeast. At the present time the drill holes are being sunk at an angle. The angle drilling has disclosed the exact formation of various bodies and is responsible for many of the new discoveries that have been made in the past year.

The extensive exploratory operations on the newer ranges have resulted in a widespread interest in the cost of drilling, and, therefore, the following figures recently compiled may be of interest. The expense of operating a drill is about $12 per shift. This includes direct and indirect labor, supplies and fuel. About 400 pounds of coal per shift is required. The actual cost of churn drilling is from $1.75 to $2 per foot, with $3 to $3.50 for diamond drilling. Contract prices range from $3 to $6 a foot, and while they undoubtedly yield a handsome profit, are quite reasonable when it is considered that this service is available anywhere on the ranges without personal inconvenience, preparation or responsibility on the part of the recipient.

In spite of heavy shipments, stockpile reserves are accumulating on the Mesabi range. The Oliver Iron Mining Co. has especially large stocks at Eveleth, Virginia and Chisholm. In the Adams district about 85,000 tons of ore remained in stock at the end of the season. At Virginia a large portion of the output of the Alpena

PROPERTIES ON THE MESABI RANGE, HAVING SHIPPED OVER 1,000,000 TONS IN 1913

pit is being stockpiled on account of a short lease. Over 2,000,000 tons has been accumulated up to date. There is another large stockpile at the Ohio mine, near the Norman; this contains about 1,000,000 tons of 60 per cent ore. In the Hibbing district, the Oliver company is stockpiling from the Dale and Uno pits in order not to fall behind on the minimum requirements of the Great Northern lease. These great stocks of ore at the mines would be of assistance in an extremely active season when shipments were unusually heavy.

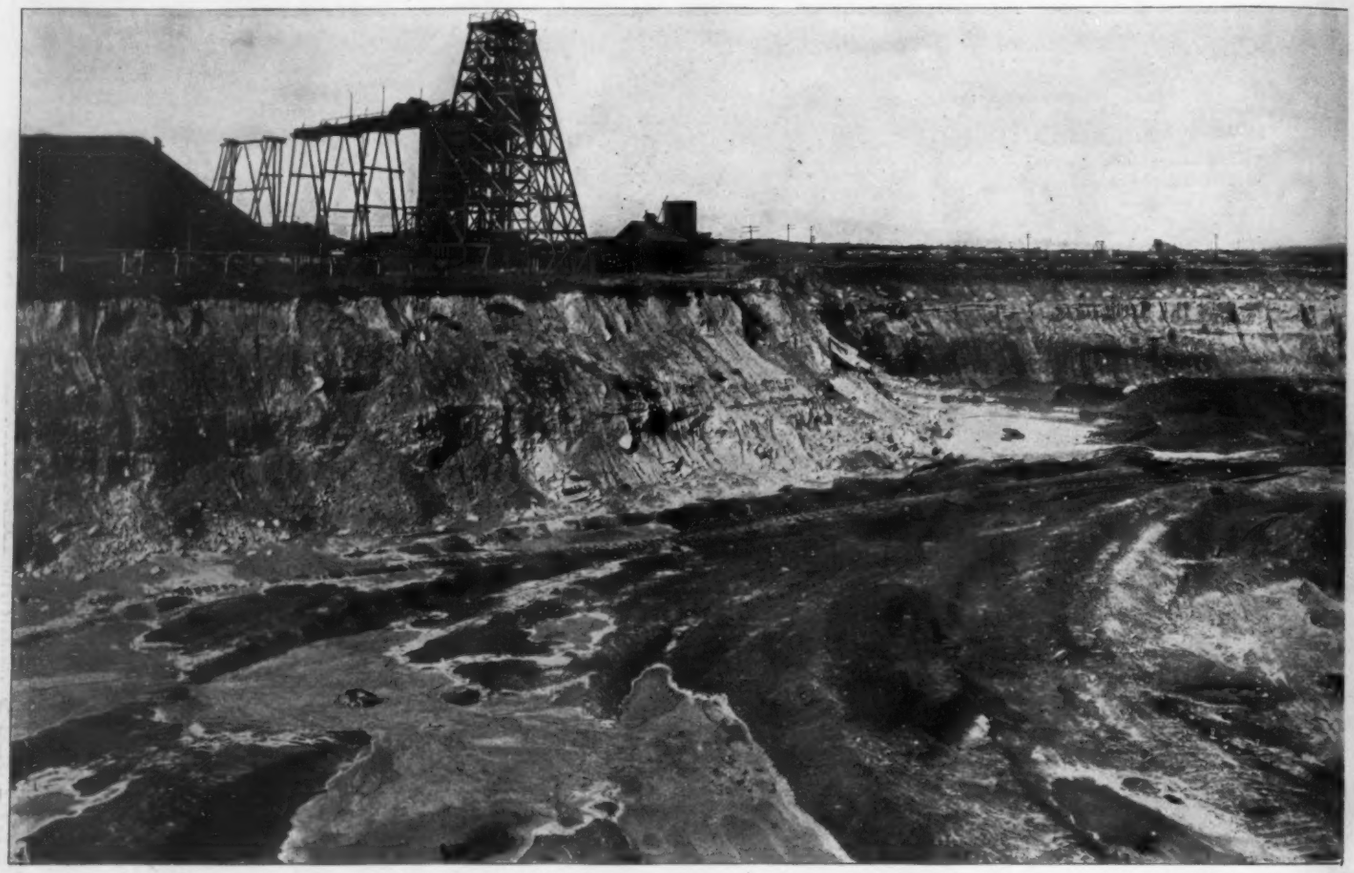
For reasons outlined earlier in this article, any improvements tending toward reductions in the cost of mining are of unusual importance at this time both to the mine operator and the ore consumer. American iron mining methods have been so perfected that extraordinary reductions in costs cannot be expected. Nevertheless, progress toward lower figures is steady. At the present time the average mining cost on the Mesabi range is about 88 cents per ton, including royalties. As the large open pits are mined out, underground methods are becoming relatively more important, and some of the far-sighted ore producers have been giving special study recently to improvements in methods of underground mining. Some particularly important experiments are being conducted in the application of coal-cutting machines to iron mining; in trying out new methods of drilling and in testing various underground loading devices.

Use of Coal-Cutting Machines

The Oliver Iron Mining Co. has been making a special trial of coal-cutting machines at the Harold mine, near Hibbing. The machines are used exactly as they come from the manufacturers, without any alterations, and are employed to undercut the ore preparatory to blasting as in coal mining. A number of air-driven augers are used in connection with the coal-cutting machines for drilling the blast holes in the ore. In using these machines an average production of 10 1/3 tons per man per day has been attained. By hand, the production is about 8 tons per man per day. But the advantage of the machine lies not so much in its increased production, as in the fact that it permits the employment of a much lower grade of labor. The machine also has the advantage of effecting a considerable saving in powder. For machine mining, the men are usually divided into gangs of eight. Two operate the cutting and drilling machines, two more do the timbering and four are employed as muckers, loading and hauling away the ore. Only the timbermen are classed as skilled. The hand miners operate in groups of two and do all of their own work, including tramming and timbering; they must all, therefore, have considerable skill.

Important results are expected to ensue from the employment of a new type of jackhammer auger for underground drilling. This machine has been tested rather thoroughly and has materially reduced the cost of drilling. Constant experiments are being made on various types of underground loading machines, and it is believed that a suitable device will be perfected within the next year or two. Such a machine would have almost a revolutionary effect on the labor situation in underground mining.

Efforts also are being made to reduce the cost of ore extraction by adopting more permanent forms of construction. The Oliver Iron Mining Co. is now using molded, reinforced concrete sets together with concrete lagging in all of its new shafts. This material has the advantage of being fireproof in addition to its permanency. The concrete sets are of the same size and shape as



LEONARD PIT AT CHISHOLM LEASED BY THE STEEL CORPORATION FROM THE GREAT NORTHERN ORE

the ordinary timber sets and are installed in the shaft in the ordinary manner. A plant for the manufacture of concrete sets, blocks and slabs, has been built at the Hibbing headquarters. It includes suitable sand and gravel screening apparatus, storage bins, a concrete mixer, etc. The sets, or concrete timbers as they are sometimes called, are molded in steel forms made of bolted, rolled sections. Hereafter all of the drys, shops, offices and other service buildings of the Oliver Iron Mining Co. will be built of two-piece concrete blocks, similar to those used at the plant of the Minnesota Steel Co., at Duluth. One of the most important developments of the year in open pit methods took place on the Cuyuna range, where the Pittsburgh Steel Ore Co. has been stripping the Rowe mine by hydraulic power. The work so far has been successful, although the pumps used last summer were of insufficient capacity. The overburden is washed down into a sump by hydraulic giants. From this point it is sucked up by a Morris sand pump and passed through a pipe line into a near-by depression. The pump has a 12-inch suction and discharge and will pass stones about 10 inches in diameter. Undoubtedly conditions on the Cuyuna range are especially favorable to hydraulic stripping, because of the loose nature of the overburden and the absence of boulders. Also in a new district, it is a comparatively simple matter to get land near the pit for the disposal of the waste material. At some of the Mesabi mines it is necessary to haul the strippings a mile or more.

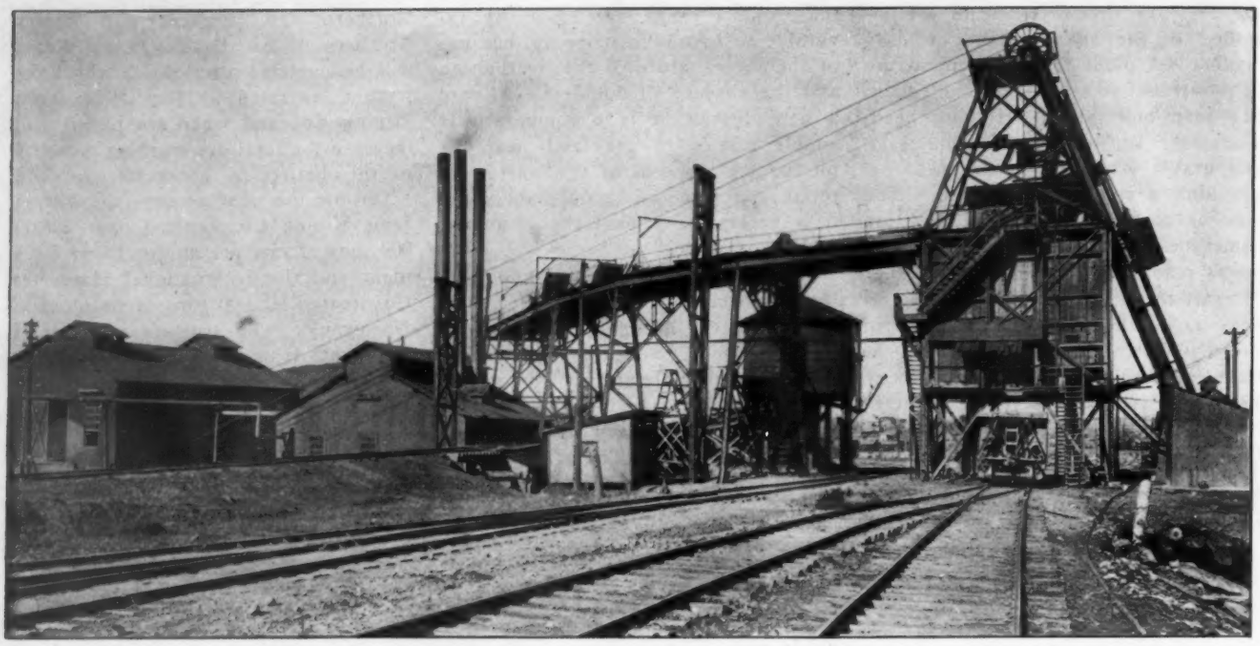
In fact, in the Chisholm and Hibbing districts, the problem of finding suitable sites for stripping dumps is becoming rather serious. The muskeg swamps which abound in this section of the country may look inviting, but in reality make very unsatisfactory dumping grounds. The stripping disappears and the muskeg bulges up. Most of the swamps seem bottomless and it is difficult to keep up tracks over them; they bulge, slide sideways and crowd up in front. Of late years, however, it has been found possible to employ the muskeg swamps by taking advantage of the cold winter months for the initial work. Sometimes after several seasons' use, such swamps make fairly satisfactory dumping grounds.

Mention already has been made of the new concentrating plants which will be built soon on the western end of the Mesabi range by the Great Northern Ore trustees and Butler Brothers of St. Paul. These plants will be modeled after the Trout Lake washer, operated by the Oliver Iron Mining Co., and when completed will increase the total ore washing capacity of the district by about 60 per cent.

During the past season, the Oliver Iron Mining Co. handled over 2,000,000 tons of raw ore at the Trout Lake plant and the International Harvester Co. treated 900,000 tons at its plant at Nashwauk. The season's concentrate shipments from the International Harvester Co.'s plant aggregated 562,746 tons. During the summer a suit was brought against the Harvester interests to enjoin them from depositing the tailings in O'Brien lake. The court, however, held in favor of the mining company on the ground that its operations were a necessary part of the development of the region.

M. A. Hanna & Co. operated their ore dryer at the Brunt mine at Mountain Iron throughout the season. This plant has proved to be very successful. The object of the treatment is to so reduce the moisture in the ore as to make it possible to mix certain amounts of undried ore with the specially dried ore so that the product will contain a normal amount of moisture. The moisture is reduced

TRUSTEES. THIS PIT AND ITS CONNECTED UNDERGROUND WORKINGS SHIPPED 1,253,480 TONS IN 1913



STEEL HEADFRAME AT THE SPRUCE MINE

from about 18 per cent to 3 per cent. The ore is dried in two revolving tubes, 49 feet long and 7 feet in diameter. They have an aggregate capacity of 1,600 tons per 24 hours.

The labor situation on the iron ranges has been watched with considerable interest during the year, largely because of disturbances in the copper country, near Calumet, Mich. The unrest of the copper miners, fortunately, was not transmitted to the iron producing districts, and labor conditions on the ranges remain unruffled. There was a brief strike on the ore docks at Two Harbors, Duluth and Superior in August, which for a time threatened to seriously interfere with the progress of the season's work. It was instigated by agitators representing the International Workers of the World, and apparently there were no just grounds for complaint. The dock companies met the situation promptly and effectively and the trouble was of short duration.

For over a year, the underground mines on the Minnesota ranges have been operating on an eight-hour schedule. The reduction in the length of the working day was made voluntarily by the mining companies and has worked out to the advantage of all concerned. It has had no appreciable effect on the cost of production, and very little on the output per shift. It may be safely stated that the average output of the eight-hour shifts at present is at least 95 per cent of that of the old 10-hour shifts. One of the reasons for this is that the men, under the new schedule, work the full time they are in the mine, whereas under the old conditions there was more or less loafing.

Early in the season the Oliver Iron

OLD MILLING PIT AT FAYAL MINE

HEAVY STRIPPING AT CORRIGAN, McKINNEY & CO.'S COMMODORE MINE NEAR VIRGINIA

Mining Co. announced an increase in wages which affected 9,000 employes. This necessitated an increase of nearly $500,000 per year in the company's pay roll. W. J. Olcott, president of the Oliver Iron Mining Co., made the following statement in regard to the increase: "The company is making a voluntary readjustment of its wages. The rates for surface labor will be advanced from $2.10 to $2.25 per day. Similar readjustments will be made on the rates of other classifications of labor, including both surface and underground. It is the purpose of the company to give the highest percentage of increase to the lowest paid employes."

The larger mining companies are adopting the policy of doing their own stripping in the winter in order to give steady all-the-year-round employment to their skilled men. Winter stripping is expensive, and undoubtedly the cost per yard would be materially reduced if the work were done by contract during the warmer seasons. But the advantages derived from keeping the mining organizations intact and from the better feeling engendered by steady employment, outweighs any increase in the unit cost of doing this work in the winter time. Undoubtedly, one of the reasons why the propaganda of the copper range agitators did not take root in the iron country is found in the firm, yet helpful and sympathetic attitude of the iron mining officials toward their employes. Strikes are exceedingly expensive and the well-contented workmen on the Minnesota ranges are no small factor in keeping down the cost of mining.

Improvements to the various iron range railroads and new dock facilities at the head of the lakes always are of importance on account of their

AGNEW PIT AT HIBBING OPERATED BY THE INTERNATIONAL HARVESTER CO.

intimate bearing on the delivered price of ore and the capacity of the ore handling machinery as a whole. The Duluth, Missabe & Northern railway has brought its line to a high state of perfection. The track and roadbed compare favorably with the best trunk lines in the east, and, therefore, this system found it unnecessary to make any radical improvements during the past year. The same may be said of the Duluth & Iron Range. The Great Northern did considerable work on its Swan River line which handled over 13,000,000 tons during the season. The improvements consisted in reballasting, laying heavier rails and minor readjustments. The most important railroad work in the iron ore region was that done by the Northern Pacific on the Cuyuna range. A subsidiary company known as the Cuyuna Northern railway was organized to build spur tracks from the main line near Deerwood to various points on the range. Up to the present time, two branches have been constructed—one extends four miles from Deerwood as far as Oreland; the other is located around the west shore of Serpent lake, penetrating what is known as the north range. This line is about seven miles in length with a terminus at the Cuyuna Mille Lacs mine. The Minneapolis, St. Paul & Sault Ste. Marie also extended its Cuyuna range line from Armour No. 2 mine through Ironton to the Pennington pit.

The year witnessed the completion of a new ore dock at Superior by the Northern Pacific; also a large amount of work was done by the Duluth,

Table I.

Approximate Shipments by Ranges.
(All-Rail Shipments Estimated for 1913.)

	1913. gross tons.	1912. gross tons.
Mesabi range	33,788,617	32,047,409
Vermillion range....	1,662,918	1,844,981
Cuyuna range	743,648	305,111
Total Minn. ship.	36,195,183	34,197,501
Gogebic range	5,500,000	5,006,266
Menominee range...	4,000,000	4,711,440
Marquette range....	4,200,000	4,202,308
Miscellaneous	161,064	104,031
Total	50,056,247	48,221,546

Missabe & Northern on its new dock No. 5 at West Duluth. The Northern Pacific dock was described in The Iron Trade Review Oct. 23, 1913, pages 729 to 733. This dock has 102 ore pockets with a capacity of seven cars each. The total storage capacity is about 35,000 tons. The height of the dock from mean water level to base of rail is 80 feet and its width, exclusive of machinery platforms, is 57 feet 2 inches. The overall length of the dock is 684 feet, including the end tower, but exclusive of the approach. It is large enough to receive two of the latest type ore carriers at one time. The D., M. & N. dock is the largest of its kind in the country, and will have a total working storage capacity of 115,200 gross tons. Its length is such that it can accommodate eight of the largest bulk freighters at one time.

During the year, according to the

Table II.

Tonnages and Assessed Valuations in Minnesota.

	Total tonnages.	Valuation of tonnage.
1906.....	1,191,969,757	$186,085,290
1907.....	1,191,969,757	$186,085,290
1908.....	1,193,188,959	174,263,632
1909.....	1,310,190,194	199,008,838
1910.....	1,347,596,291	220,423,038
1911.....	1,367,457,803	231,617,949
1912.....	1,401,340,743	254,002,774

Minnesota tax commission, increases in the ore tonnage estimated for taxation purposes were made on 84 properties aggregating 45,427,092 tons, and decreases were allowed on 24 properties, aggregating 1,655,127 tons. There is, therefore, a net increase in tonnage of 43,771,965. This is a fair measure of the amount of new ore uncovered by prospecting and exploring. The third biennial report of the Minnesota tax commission, recently issued, which contains figures down to the close of 1912, gives the aggregate amount of ore in the ground in the state as 1,401,340,743 tons, with an assessed valuation of $254,553,179. The relative value of the iron ore lands readily may be appreciated when these figures are compared with the $4,865,098, which is the assessed valuation of the non-mineral lands in the iron belt. For comparative purposes, the 1911 figures are given as follows: Total tonnage, 1,367,457,853; assessed valuation $232,367,969.

Assessing Ore Properties

There recently has been so much agitation concerning the relative accuracy of various methods of assessing iron ore properties that the methods of the Minnesota tax commission may be of interest. Under the Minnesota system, mining properties are divided into three groups—operating mines, reserves and sub-reserves. These groups are subdivided into six classes of operating mines, six classes of reserves and two classes of sub-reserves, and a different rate of taxation is applied to each class. The six classes of operating mines are as follows:

Class 1.—Properties where mining is comparatively inexpensive and the ore high grade.

Class 2.—Properties where mining is comparatively inexpensive and the ore of lower grade.

Class 3.—Properties where mining is somewhat more difficult, and mining cost greater than in class No. 2.

Class 4.—Underground properties where the expense of mining is comparatively low and the ore of high grade.

Class 5.—Underground or milling pit properties of distinctly second grade, determined by a higher cost of mining and a lower grade of ore than in class 4.

Class 6.—Mines of inferior character where expenses of operation are high.

Reserves may be described briefly as mineral properties that have been drilled and tested and upon which a measurable tonnage of merchantable ore is known to exist. The rates for computing tonnage valuation range from 34.65 cents for active mines in class 1, to 14.7 cents for active mines in class 6. The rate on reserves varies from 22.05 cents to 8.4 cents per ton.

Ore Selling Movement

The ore selling movement for 1913 delivery was precipitated Nov. 19, 1912, by the sale of between 4,000,000 and 5,000,000 tons by Pickands, Mather & Co., the Cleveland-Cliffs Iron Co. and M. A. Hanna & Co. The price of Mesabi Bessemer was fixed at $4.15 and Mesabi non-Bessemer at $3.40. These figures are 10 cents below the 1911 quotations, and this advantage obtained by the consumer was due in part to the reduction of the freight rate on the ore-carrying railroads in Minnesota late in 1911. There was also a reduction of 5

Table III.

Lake Superior Dock Shipments.

	1913. gross tons.	1912. gross tons.
Great Northern	13,060,811	13,935,602
Duluth, Missabe & Northern	12,331,126	10,495,577
D. & I. R.....	10,075,718	9,370,969
N. W., Ashland....	3,505,838	3,778,614
Soo, Ashland	832,392	1,018,487
Soo, Superior	696,334	305,112
N. P., Superior....	31,194	.....
Total	40,533,413	38,904,361

cents in the unloading charge at lower lake ports. The 1913 price was established without a meeting of any kind. This forms a striking contrast with the animated discussions that took place years ago at the meetings of the ore men. With one exception, the 1913 buying movement was the earliest on record. Conditions this year are such that an early buying movement may not be expected, and if the event takes place before April

Table IV.

Shipments From Principal Minnesota Mines for 1912 and 1913

These figures are preliminary and approximate and are presented in advance of the complete, corrected figures which will appear in a later issue of The Iron Trade Review.

Mesabi Range.

Oliver Iron Mining Co.

Mine.	1913. Gross tons.	1912. Gross tons.
Adams District:		
Adams	1,021,290	993,523
Leonidas	558,826	.....
Spruce	544,887	740,801
Union	150,311	213,829
Norman	276,770	.....
Graham	100,516	.....
Vivian	9,111	.....
Fayal District:—		
Fayal	1,257,430	468,019
Genoa-Sparta	1,141,796	1,315,840
Gilbert	104,538	135,622
Virginia District:		
Alpena	1,409,124	1,025,301
Fay	296,059	.....
Missabe Mountain	321,835	.....
Hibbing District:		
Hull-Rust	3,457,608	2,232,112
Sellers	268,070	.....
Burt-Pool	622,951	.....
Winifred	43,109	91,806
Dale	621,540	1,106,808
North Uno	381,847	545,033
South Uno	1,202,454	1,305,216
Harold	92,060	187,926
Mace	141,242	136,524
Mississippi	122,984	274,729
Chisholm District:		
Glen	15	.....
Myers	39,951	101,558
Clark	402,966	500,768
Chisholm	641,854	695,859
Monroe	485,880	.....
Leonard No. 2	347,873	.....
Leonard Pit	905,606	2,198,119
Leonard-Burt	2,862	15,932
Hartley-Burt	7,506	.....
Crescent Trespass	1,022	.....
Canisteo District:		
North Star	278,647	.....
Holman	472,775	919,699
Canisteo	1,099,748	2,099,880
Judd	103,495	.....
Delaware	9,547	.....
Hill	846,663	1,188,908

Pickands, Mather & Co.

Albany	350,000	244,669
Bangor	130,000	130,997
Corsica	250,000	196,188
Elba	125,000	168,990
Hudson	250,000	224,548
Kellogg	.....	127,412
Malta	90,000	2,187
Minorca	80,000	37,235
Mohawk	200,000	161,539
Scranton	240,000	254,500
Troy	70,000	.....
Utica	350,000	223,006
Virginia	350,000	200,182
Yawkey	50,000	.....

Republic Iron & Steel Co.

Bray	100,000	164,732
Franklin	50,000	69,993
Kinney	500,000	530,080
Monica	75,000	92,754
Onondaga	40,000	.....
Pettit	200,000	157,208
Schley	200,000	159,126
Union	285,000	215,829

M. A. Hanna & Co.

Brunt	200,000	215,585
Croxton	75,000	146,290
Hanna	300,000	211,822
La Rue	250,000	155,552
Sliver	325,000	378,541

Joseph Sellwood Group.

Adriatic	109,395	102,478
Cyprus	81,298	100,063
Morrow	90,596	.....
Pearson	103,141	75,969
Perkins	118,808	60,523

Rogers-Brown Ore Co.

Iroquois	150,000	80,000
Susquehanna	1,100,000	583,910

The Shenango Furnace Co.

Mine.	1913. Gross tons.	1912. Gross tons.
Shenango	1,000,000	805,413
Webb	300,000	166,636
Whiteside	300,000	275,915

Jones & Laughlin Steel Co.

Fowler-Meadow	100,000	204,584
Grant	650,000	399,848
Leetonia	500,000	368,301
Lincoln	200,000	173,979
Longyear	200,000	.....

Pitt Iron Mining Co.

La Belle	15,000	14,896
Miller	350,000	301,513
Ruddy	40,000	36,551
Wacotah	.....	129,073

A. B. Coates Group.

Madrid	95,000	26,906
Section 17	30,000	4,203
Seville	5,000	6,023

Corrigan, McKinney & Co.

St. Paul	.....	42,597
Stevenson	600,000	682,514
Commodore	1,000,000	576,855

International Harvester Co.

Agnew	100,533	101,498
Hawkins	562,746	473,120

Oglebay, Norton & Co.

Woodbridge	150,000	68,089

New York State Steel Co.

Knox	20,000	101,169

Inland Steel Co.

Grace	100,000	60,641
Laura	200,000	270,411

Mahoning Ore & Steel Co.

Mahoning	2,000,000	1,518,643

The Tod-Stambaugh Co.

Morton	150,000	5,948
Biwabik	300,000	312,378

Cleveland-Cliffs Iron Co.

Crosby	250,000	188,368

Clare Iron Co.

Elizabeth	.....	392

Meriden Iron Co.

Pearce	120,000	.....

Swallow & Hopkins

Helmer	50,000	.....

Cavour Mining Co.

Cavour	150,000	47,919
Roberts	.....	12,384

Yawkey Estate

Larkin	.....	16,542

Thomas Furnace Co.

Williams	135,000	37,274

White Iron Lake Iron Co.

Euclid	25,000	49,590

Vermillion Range

Soudan	100,885	88,714
Pioneer	520,308	647,237
Sibley	249,263	309,076
Savoy	74,976	90,528
Zenith	433,696	478,682
Chandler	125,000	73,370
Section 30	158,880	157,344
White Iron	.....	30

Cuyuna Range

Armour No. 1	105,086	49,539
Armour No. 2	175,437	49,031
Kennedy	266,125	196,653
Thompson	47,000	9,888
Cuyuna-Mille Lacs	20,000	.....
Cuyuna-Duluth	10,000	.....
Pennington	110,000	.....
Barrows	10,000	.....

1, the sellers will have little complaint. In dull seasons buyers always have been inclined to hold off until the last moment and in 1909 there was little actual buying until May 10. Any efforts to predict the prices which will be made for 1914 delivery would be fruitless at this time, although it is now expected there will be a reduction of at least 25 cents a ton. If business conditions show no improvement during the first quarter, the cut in price may amount to as much as 50 cents a ton.

In 1911, the average amount of iron natural in Mesabi range ores was 51.1824 per cent, and in 1912 it was 51.1958. Definite figures for 1913 are not available, but there is little question of a maintenance of the mark set in 1912. This is due, to a large extent, to heavy shipments of high grade ores from Great Northern properties operated under the Hill lease. However, after next year, some reduction in the average iron content in Mesabi range shipments may be expected. The average phosphorus in Bessemer shipments has been rising consistently for a number of years, and it is now believed that 1913 will be no exception to the general trend. In 1912, 41.9 per cent of the ores shipped were of Bessemer grade. This ratio may be slightly increased in 1913, owing to heavy Bessemer shipments from the Hibbing district.

New Year Opens with Hopeful Signs in East

(*Continued from Page 14*)

furnace, or close to the level of this grade at the end of 1911. Some grades of eastern Pennsylvania No. 2X were offered at $14, furnace. The net declines of the market in eastern Pennsylvania in the year, were about $3.50 in basic, $3 in foundry, $3 in standard forge and $3 to $3.50 in standard low phosphorus.

The eastern basic market continues to show only a limited number of buyers, owing to various steel works having added their own blast furnace capacity in recent years and the tonnage of the past year has been moderate. The best buying of this grade after a several months' decline was shown in March and April, when sales reached 60,000 to 75,000 tons, including 45,000 tons for the Lukens Iron & Steel Co., at $16.50, delivered. The latter, which remains the principal buyer of basic in the east, also took 30,000 tons in August at $15, delivered. This latter sale set a new inside point from which the market over the rest of the year had not reacted.

Foundry irons steadily declined up to July, when under a short buying movement, prices strengthened 25 to 50 cents a ton. The drop in values then resumed until at the end of the year some eastern brands of No. 2X were offered at $14.85, Philadelphia, though the market for the standard irons was about 25 cents higher. The Reading Iron Co. was an unexpectedly large buyer of forge iron in the eastern market in the year, owing to the fact that some of its furnaces underwent repairs and also that prices were very attractive. This consumer took 10,000 to 15,000 tons in March and on later dates was a buyer of equally large lots. The Delaware River cast iron pipe makers as usual were heavy buyers of low grade northern and southern irons. The United States Cast Iron Pipe & Foundry Co. closed for heavy blocks of northern and southern grades at various times. In December, it was also negotiating for 20,000 to 30,000 tons, but could not develop quotations in line with its ideas of the market. R. D. Wood & Co., the Standard Cast Iron Pipe & Foundry Co., the Warren Foundry & Machine Co. and others, were all liberal buyers, especially in the first half, when their shops were running full. Low phosphorus iron moved in line with the general decline in the market. After the passage of the tariff, domestic makers were obliged to cut their schedules $1.50 to $2 a ton to meet the competition of English irons of this character. Sales in December were made at $20.75, delivered, eastern Pennsylvania.

Buffalo makers, as usual, have been very aggressive sellers of foundry, malleable and basic grades, especially in upper New Jersey, metropolitan and New England districts, where their price schedules were such as to dominate the market. At the beginning of 1913, Buffalo No. 2X was at $17.50 to $18, furnace. It closed at $12.75 to $13.25, furnace, equivalent to $14.75 to $15.25, tidewater, and $15.20 to $15.70, New England. The latter inside figure had approached so closely the minimum of the low market two years previously that buyers were more actively taking advantage of their opportunities and fair selling was being done.

Furnace Operations

Blast furnace operations in eastern Pennsylvania and in tributary districts showed 16 strictly merchant stacks and 16 out of 27 steel works furnaces blowing at the close of 1913. One year preceding 24 merchant furnaces were producing and 34 were idle. In the steel works group, the active list had numbered 22 out of a possible total of 27.

Total stocks of iron, both merchant and non-merchant, showed little change over the corresponding date in the previous year. In the eastern Pennsylvania district, the iron accumulated at merchant stacks was higher in December, 1913, than in December, 1912, yet it was considerably under 100,000 tons. The greater activity of the furnaces during the first half of the year had resulted in the same increase in the iron piled on banks. A steady increase was shown to July. From that point, when makers by successive stages cut their production to meet the falling market, the stocks gradually decreased. This reduction, however, was not sufficient to overcome the gain in iron on hand that came in the previous six months. On June 1 a compilation of merchant stacks in eastern Pennsylvania and Virginia showed a tonnage which was 60½ per cent of the figures on June 1, 1912.

Steel makers also piled little additional iron in the year. In fact, one of the largest eastern companies in December had on its yards only one-half the tonnage shown 12 months before and only one-quarter the tonnage of two years ago. It had added only 3,000 tons over the low point in the year, which was in the second quarter. Other steel makers had regulated their output in similar fashion.

Virginia makers began the year of 1913 with an order book of more than 200,000 tons and with a $16, furnace, market for No. 2X. Their position at the start of 1914 was much less favorable. Total orders had shrunken to about 70,000 tons and prices, under a sluggish selling movement, were on the basis of $12.75 to $13, furnace, for No. 2X. Stocks on furnace banks,

however, showed a net decline of about 40,000 tons in the year and in the final month were approximately 75,000 tons. The leading Virginia producer, the Virginia Iron, Coal & Coke Co., had continued to work off most of its large stocks accumulated as far back as 1907, and it now is carrying about 50,000 tons of iron, which it aims to keep as a permanent reserve.

Show Weakness Early

All but 50 cents per ton of the $3 decline of Virginia iron in the year fell within the first half. The market first showed weakness in January, and prices fell away quickly in February until $13.50 was reached in June. The $13 price appeared shortly thereafter and the market remained almost stationary, probably due to the imminence of the cost line, though producers were unable in the last quarter to compete very successfully in eastern districts against the dropping northern irons, and $12.75, furnace, was appearing. At the close of the year, eight Virginia furnaces, or slightly over 50 per cent of capacity, were blowing, including Dora, Radford, Crozer, Princess, Pulaski, Covington, Iron Gate and Oriskany. The last named was a completely new plant at Lynchburg. On Jan. 1, 1913, six Virginia furnaces were in blast.

A comparative statement of the merchant and non-merchant furnaces in the principal eastern manufacturing districts in blast at the close of 1913 and 1912 follows:

	—1913—		—1912—	
	Mer-chant.	Non-Mer-chant.	Mer-chant.	Non-Mer-chant.
Lehigh Valley	4	7	9	7
Schuylkill Valley.....	3	4	4	6
Lebanon District.....	4	3	5	6
Central Pennsylvania.	2	0	4	0
New Jersey.....	2	0	1	0
Maryland	0	2	0	3
Tidewater	1	0	1	0
Totals	16	16	24	22

Awards for subway and elevated railroad construction in New York City made the year for structural steel tonnage one of the largest on record in the metropolitan and all eastern districts. Yet in the diversity of the work placed, the list fell much below the scale of the previous year and can be ranked only in the fair class of activity. The lively market in the earlier months of the year flattened out decidedly from midyear onward, and in the final quarter, the movement of contracts was extremely sluggish. One reason commonly ascribed for the quieter structural market during these months in New York was the reluctance of banking interests to continue to finance the building of structures of the speculative class, such as apartments and lofts, the construction of which, in recent years, has been large. Total awards of fabricated steel in New York City in the year are estimated at fully 300,000 tons, which represents about the normal year for the metropolis. In the whole eastern district there were about 600,000 tons. About 125,000 tons of this was for subway and elevated work, of which about 100,000 tons went to the American Bridge Co. and the remainder, about 25,000 tons, to the Pennsylvania Steel Co. and the Lackawanna Steel Co. Total bookings in 1913 of the American Bridge Co. in its eastern division were about 300,000 tons, compared with about 350,000 tons in 1912. Its eastern shops, at the start of 1914, had four months' work scheduled. Because of its heavy obligations for subway and elevated work, this producer was obliged to decline to bid upon about 80,000 tons in the year. The Equitable building, New York City, which was considered to have been placed the preceding year but was held up by some hitch in the plans, was re-awarded in the year to the American Bridge Co. This structure will require 36,000 tons of steel, and will be the largest commercial building in the world. Fabricated prices became poor during the closing months, though at no time in the year had they reached high figures.

Low Prices for Scrap

A rather remarkable condition has existed in the scrap market the past year. Despite the unprecedented activity of steel works and foundries during the first six months, prices for old material showed little buoyancy and at all times were heavy and sluggish. No. 1 heavy melting steel, delivered eastern Pennsylvania, sold at the unusual range of $2.75 to $4.25 below basic pig iron; heavy machinery cast from $2.25 to 4.25 below No. 2X, and No. 1 railroad wrought at from 50 cents to $1.50 below standard gray forge. The highest level of scrap prices was shown in January, and the decline from that time was steady, despite occasional buying flurries which usually were of short duration. Heavy melting steeel in the 12 months dropped $4.50 a ton, railroad wrought $3 a ton and heavy machinery cast $3.25 a ton.

Various theories are given for the heaviness of the scrap market. The open winter of 1912 and 1913, permitting an uninterrupted collection of material, is commonly accepted as a leading cause for the surplus supply over the demand that seemed, generally, to be available. There seems but little doubt, however, as far as the eastern district is concerned, that the more general adoption of direct pig metal and duplexing processes by steel makers have played a big part in reducing the consumptive requirements of these buyers, especially when maximum ingot tonnages have been sought. At the close of the year, the unusually low prices for scrap were opening some opportunities for export.

Few Car Orders

What small support the railroads gave the steel market during the last 10 months of the year in the important branch of equipment buying, shows up clearly in the record of car orders placed in the United States during 1913. Total orders distributed to builders in the year only slightly exceeded 100,000 cars as compared with 235,000 cars placed in 1912 and about 125,000 cars in 1911. This estimate is based upon reliably compiled statistics, but it does not include those cars built by the railroads in their own shops or the orders for car parts such as steel underframes, center constructions, bodies, etc., of which there were some thousand.

The monthly record of car purchases in 1913 shows that fully one-half of the equipment contracts of the year were closed during the months of January and February, which proved to be the tail-end of the great activity of the market throughout most of the preceding year. More than 50,000 cars were placed during the first two months of the year. Large single orders were few in number in 1913. The principal lots to be awarded at one time were 12,283 cars for the Harriman lines and 12,305 cars for the Pennsylvania system, both of which were closed early in the year.

As the year closed, the low market for steel was enabling the car builders to again offer attractive price propositions to the railroads and the indications pointed to a considerable revival in the equipment field before many months.

The number of cars, passenger and freight, ordered by the railroads of the United States in 1913, as compiled from carefully verified statistics, is given by months as follows:

January	32,000
February	22,000
March	5,000
April	13,500
May	10,000
June	2,500
July	1,000
August	2,000
September	2,000
October	7,500
November	2,500
December (estimated)	3,000
Total for the year.....	100,000

Locomotive orders were quite good

during the early part of the year but declined rapidly in the later months, especially during the last half. Among the largest contracts were 144 locomotives placed by the Pennsylvania railroad with the Baldwin Locomotive Works.

Rail Buying Slow

A sharp contrast appears between the position of the rail mills of the country at the beginning of 1914, as compared with 12 months earlier. The mills began 1913 with estimated aggregate bookings of 3,000,000 tons, and many of them were so filled that they had very little vacant manufacturing space up to midyear. At the present time, the total tonnage of rails placed for 1914 delivery does not exceed 400,000. The railroads have been slow to act upon their requirements, apparently owing to the less favorable state of general business conditions, and there was no pressure upon them to hurry in their orders to insure an early mill position, such as was the case a year ago. The agitation for an increase in freight rates now pending may have had something to do with the tardiness of their action. The first rail orders for 1914 shipment were placed in September by the comparatively smaller roads, the Missouri, Kansas & Texas and the Nickel Plate. There was then an intermittent buying which brought the total orders in September to about 60,000 tons; in October to 150,000 tons; in November to 60,000 tons, and in December to an estimated figure of about 100,000 tons. Neither the New York Central nor the Pennsylvania systems had covered upon their needs at the opening of 1914. The principal orders for 1914 delivery that had been closed by Jan. 1 were 25,000 for the Burlington, 30,000 for the Great Northern, 24,000 for the Reading, 45,000 for the Louisville & Nashville, about 50,000 tons for the Southern Pacific and 29,000 tons for the Norfolk & Western.

Shipbuilding Orders Less

The shipbuilding industry along the Atlantic coast in the year was considerably less active with respect to new orders placed than during the preceding 12 months. New construction carried out, however, was large. Returns from the six largest yards of the east show a total tonnage of 160,000 in the most important work, including government contracts, completed in the year. About 300,000 tons is now under construction, but more than half of this is in six battleships. The yards began the year with good order books and operated well for a number of months, but suffered during the last half when the volume of new contracts was comparatively light. Financing difficulties seem to have held a large number of prospective contracts in suspense, for builders were called upon to render estimates on many inquiries which did not mature beyond this preliminary stage. At the close of the year, a number of projects which had been before builders in some active form during that period, still were carried in the prospective list. In this last were large sized vessels for the United Fruit Co., the Clyde Steamship Co., the Hamburg-American Steamship Co. and others.

By reason of the preferential exemptions accorded boats of American registry in the use of the Panama canal, foreign shipping companies continue to show interest in having built upon this side such vessels as are intended for new lines to be established through the canal. The Hamburg-American Steamship Co. was one of these interests which figured with American yards. The feeling is still entertained in the east that the opening of the Panama canal will prove of lasting benefit to the shipbuilding companies of the Atlantic coast. The acquirement of the plant of the Fore River Shipbuilding Co., Quincy, Mass., by the Bethlehem Steel Co., was an important event of the year in eastern shipbuilding circles.

The following are the principal steel vessels completed during the year or now under construction, giving the general type and the gross tonnage of each:

NEW YORK SHIP BUILDING CO.

Vessels Completed.

Name.	Gross tonnage.
Washington Irving, passenger	3,104
Vesta, tank steamer	3.663
Socony, tank steamer	3,663
Norfolk, collier	3.521
Congress, passenger and freight	7,985
No. D 24, car float	1.015
No. D 25, car float	1,015
Tyler, freighter	3,928
No. 32, car float	840
No. 33, car float	840
No. D 53 car float	1,015
No. D 54 car float	1,015
Santa Clara, ferry boat	2,000
No. 6, car float	800
No. 13, car float	800
Total tonnage	35,204

Under Construction.

Moreno, battleship	27,650*
Fei Hung, cruiser	2,600
Oklahoma, battleship	27,500*
Downes, destroyer	1,010
Ericsson, destroyer	1,050
No. 61, destroyer	1.090
No. 62, destroyer	1,090
Melville, destroyer tender	7,150
Hampden, collier	4,727
Mayor Gaynor, ferry	1,075
Car float	925
Car float	925
No. 3, car float	725
No. 18, car float	1,385
Total tonnage	78,902

WM. CRAMP & SONS SHIP & ENGINE BUILDING CO.

Vessels Completed.

Name.	Gross tonnage.
Santa Cruz, merchant	4,800
Santa Clara, merchant	6,000
Santa Cecilia, merchant	6,000
Santa Cataline, merchant	6,000
Total tonnage	22,800

Under Construction.

Aylwin, torpedo boat	1,010
Parker, torpedo boat	1,010
Benham, torpedo boat	1,010
Balch, torpedo boat	1,010
O'Brien, torpedo boat	1,050
Nicholson, torpedo boat	1,050
Winslow, torpedo boat	1,050
Destroyer, No. 58	1,090
Destroyer, No. 59	1,090
Sacramento, merchant	1,425
Two express steamers, each	10,000
Car ferry steamer	.....
Total tonnage about	33,895

NEWPORT NEWS SHIP BUILDING & DRY DOCK CO.

Vessels Completed.

Name.	Gross tonnage.
Illinois, tank	5,225
Lorenzo, freight	3,063
Tamssi, barge	658
Matsonia, freight and passenger	9,729
Topila, tank	5,125
Hanoa, freight and passenger	6,900
L. K. Thurlow, freight	3,178
Nereus, collier	10,168
Total tonnage	44,046

Under Construction.

Menoa, freight and passenger	6,900
J. D. Archibald, tank	8,000
Neches, freight	5,800
Medina, freight	5,800
J. D. Rockefeller, tank	8,000
Texas, battleship	.....
Pennsylvania, battleship	.....
Oil barge, U. S. navy	.....
Oil barge, U. S. navy	.....
Total tonnage (estimated)	90,000

FORE RIVER SHIP BUILDING CORPORATION

Vessels Completed.

Name.	Gross tonnage.
Frieda, bulk cargo	2,993
Richmond, tank steamer	6,563
Duncan, destroyer	1,010
Total tonnage	10,566

Under Construction.

Rivadavia, battleship	27,600*
Nevada, battleship	27,500*
Cushing, torpedo boat	1,050
Amolco, tank steamer	2,500
Atlantic, freight steamer	5,500
Pacific, freight steamer	5,500
No. 57, destroyer	1,090
Total tonnage	70,740

HARLAN & HOLLINGSWORTH CORPORATION.

Vessels Completed.

Name.	Gross tonnage.
Narragansett, passenger and freight	3,539
Manhattan, passenger and freight	3,539
Bayonne, ferryboat	907
No. 45, car float	852
No. 46, car float	852
Salem, ferryboat	774
Bridgeton, ferryboat	774
No. 426, car float	1,300
No. 47, car float	880
Total tonnage	13,417

Under Construction.

Ferryboat, unnamed	750
Excursion boat, unnamed	700
Total tonnage	1,450

MARYLAND STEEL CO.

Vessels Completed.

Name.	Gross tonnage.
Jason, collier	10,650
Montana, freighter	6,649
Pennsylvania, freighter	6,649
Panama, freighter	6,649
City of Annapolis, freight and passenger	1,923
City of Richmond, freight and passenger	1,923
Steel dump barge	1,000
Steel dump barge	1,000
Total tonnage	36,443

Under Construction.

Washington, freighter	6,649
Iowan, freighter	6,649
Ohioan, freighter	6,649
Steel dump barge	1,000
Steel dump barge	1,000
Steel dump barge	1,000
Steel dump barge	1,000
No. 155, lighter	549
No. 156, lighter	549
Total tonnage	25,045

*Displacement.

Export Trade Less Active

Export trade of the steel industry of the United States in 1913 was not as large as the record year that preceded it. It is estimated to have reached about 2,500,000 tons the past year, compared with 2,947,596 tons in 1912. This falling off probably was due to a quieter condition of business in the world's markets generally the latter part of the year and in some part to the heavy demands on the mills by domestic consumers in the earlier part of that period which then left some makers a smaller tonnage than usual to offer to foreign buyers. Early in the year, opportunities for exporting southern pig iron to Mediterranean points on account of the advanced English market, were numerous and a round tonnage, principally of foundry grades, was booked from that source by Alabama furnaces at prices which compared very favorably with the domestic market.

Miscellaneous Events

Membership of the American Iron and Steel Institute in the year passed the 1,000 mark and now is exactly 1,047, an increase of about 200 in the year. As the official organization of the iron and steel industry and allied interests, the institute continues to extend its prominence and influence throughout the country. Very successful meetings were held in New York in May and in Chicago in October.

The death of J. Pierpont Morgan, March 31, was of great and peculiar interest to the steel industry, as a whole, owing to his work as the organizer of the United States Steel Corporation. It often has been said that the Steel Corporation represents the master stroke of business genius of the great financier.

On Feb. 13 occurred at his home in South Bethlehem, the death of John Fritz, the great pioneer in the development of the modern rolling mill. He was 91 years of age.

Among the important personal changes in the eastern iron and steel industry was the election of E. G. Grace as president of the Bethlehem Steel Co., succeeding Charles M. Schwab, who became chairman of the board, a newly-created position. Mr. Schwab remains president of the Bethlehem Steel Corporation. Ralph H. Sweetser became president of the Thomas Iron Co., succeeding B. F. Fackenthal Jr., resigned.

In February, a petition in bankruptcy was filed against Milliken Bros., Inc., of Staten Island, whose affairs have been in the courts for the past five or six years. The steel works, rolling mills, bridge shop and other property of the company subsequently was bought in by the bondholders and a plan of reorganization now is being matured by which it is hoped to again put the works in full operation. The bridge shop of this company has been steadily operating, but the steel works and structural mill have been idle for several years.

Steel Corporation Bookings

A steady shrinkage of unfilled orders on its books was shown by the monthly reports of the United States Steel Corporation throughout the year. Its total loss in the year of tonnage awaiting manufacture was about 3,630,000 tons. The heaviest declines were sustained in April, May and June, when the market began to contract sharply. October also was a month of heavy loss. Owing to the severe retrenchment of operations, the booked tonnage loss was much reduced at the year's close, but this was not due to any expansion of new orders. On Dec. 31, 1913, the accumulated orders of the Steel Corporation were at the lowest point since Oct. 31, 1911.

The following is the statement of unfilled orders by months in 1913, showing the net changes:

Dec. 31, 1913	*4,300,000	*100,000—
Nov. 30, 1913	4,396,347	117,420—
Oct. 31, 1913	4,513,767	490,018—
Sept. 30, 1913	5,003,785	219,683—
Aug. 31, 1913	5,223,468	175,888—
July 31, 1913	5,399,356	407,965—
June 30, 1913	5,807,317	517,005—
May 31, 1913	6,324,322	654,440—
Apr. 30, 1913	6,978,762	490,194—
Mar. 31, 1913	7,468,956	187,758—
Feb. 28, 1913	7,656,714	170,654—
Jan. 31, 1913	7,827,368	104,796—
Dec. 31, 1912	7,932,164	79,281+

*Estimated.

Keeping Foundry and Shop Lights Clean

In walking through a foundry and machine shop of the middle west, which was in most respects up-to-date, the writer recently remarked to the superintendent on the dirty, grimy condition of the numerous lamps and reflectors with which the shops were lighted, asking him why he didn't have them cleaned.

"Oh!" he replied, "it's cheaper to keep enough of them going all the time to give us ample light than it is to send men up there to clean them."

The writer asked him whether he had ever heard of a device known as a "cut-out hanger" which enables both the lamp and reflector to be lowered to floor from any height, quickly cleaned or renewed and hoisted into place again.

He said he had not and would be glad to have the name of the manufacturer, which was given to him.

For the benefit of any others similarly situated it may be said that the hanger consists of a suspension device in two parts, namely the upper fixture, shaped like an inverted cup, which can be attached to ceiling, bracket or span wire, and a disconnecting socket carrying the lamp and reflector. By means of this hanger, any lamp can be automatically cut-out of a multiple circuit, lowered or raised with a rope, and the connection to the circuit broken or restored by snap latches, catches and contact bars. The lights are naturally attended to in a fraction of the time necessary when ladders are used, and in shops where the crane has been depended upon by the trimmers, this expensive piece of equipment is saved for other work or from service overtime. Furthermore, all danger from electric shocks is eliminated. The greatest advantages, however, are derived from the saving of current, and the clear, uniform illumination made possible by good lights, which usually has a decided influence on the quality of the work. This hanger is manufactured by the Thompson Electric Co., Cleveland.

An eight-page bulletin, describing a power counter for use on engines, pumps, compressors, etc., manufactured by the H. Maihak Aktiengesellschaft, Hamburg, Germany, is being sent to the trade by Herman Bacharach, 1009 Hartje building, Pittsburgh. This device determines the mean horsepower of reciprocating engines over any desired period of time, taking into account every diagram developed.

Fig. 1—Charging floor of Edgar Thomson open-hearth plant

How the 14 Furnaces Are Arranged

THE steel-producing capacity of the historic Edgar Thomson works of the Carnegie Steel Co., Braddock, Pa., recently has been increased by the erection of 14 open-hearth furnaces. The Edgar Thomson plant is built on the site where General Braddock fought his last battle in 1755, and where later the insurgents of the Whiskey Rebellion assembled and took council before advancing on the city of Pittsburgh.

The plant, originally built in 1872, now consists of 11 blast furnaces, three foundries, 14 open-hearth furnaces, three rail mills, splice bar and briquetting plants, Bessemer department and auxiliary mills and shops.

Open-Hearth Rails

According to Charles E. Dinkey, general superintendent of the Edgar Thomson works, the erection of an open-hearth plant has been under consideration since 1895, this addition having been made almost imperative by the steadily growing demand for rails so low in phosphorus content that they cannot readily be furnished in Bessemer steel.

The new open-hearth department consists of 14 furnaces of the stationary type, together with gas producer plant, stock yard, skull cracker, cinder recovery yard, calcining and spiegel cupola plants. The furnaces are capable of producing approximately 90 to 100 tons per heat, and the rated output per month for the whole plant is 70,000 tons.

The open-hearth building is 150

FIG. 2—TAPPING AND POURING SIDE OF OPEN-HEARTH PLANT, SHOWING ONE OF THE LARGE LADLES

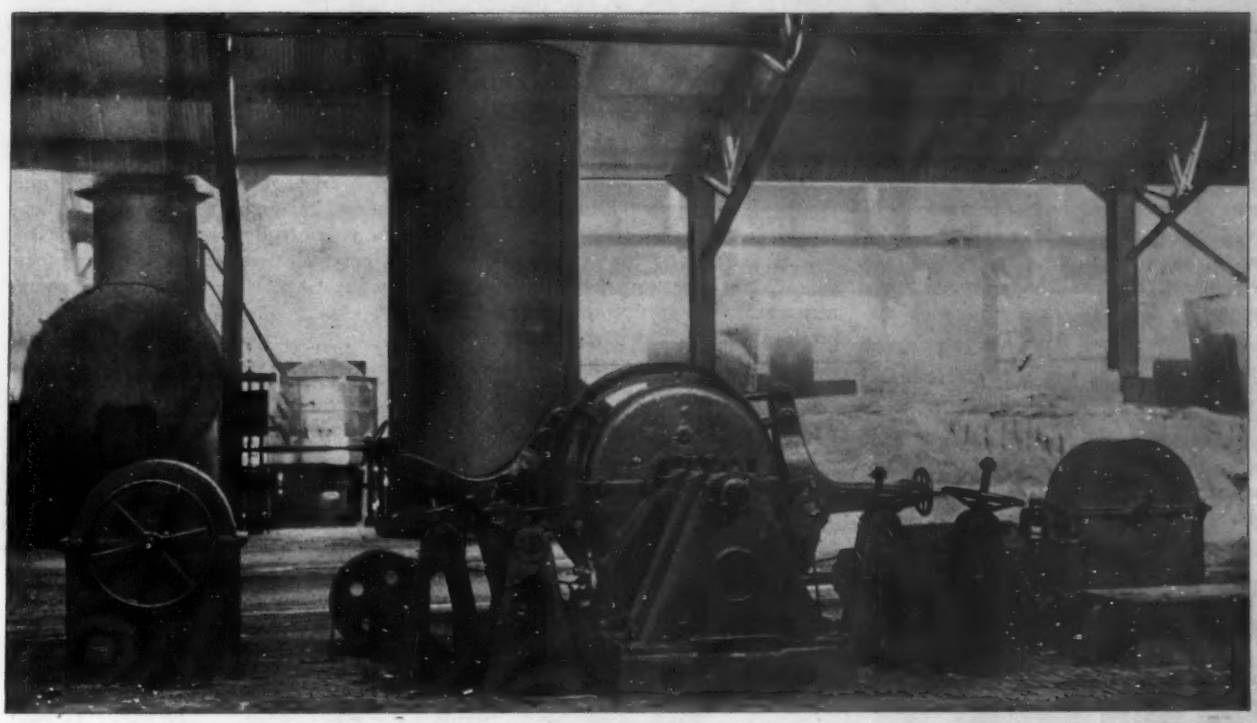


FIG. 3—THE VALVE REVERSING MECHANISM OF ONE OF THE OPEN-HEARTH FURNACES

feet wide by 1,230 feet long, with a lean-to 41 feet 6 inches wide extending the entire length of the main building on the north side. The pouring side of the plant is 64 feet wide, and the charging side is 84 feet wide. The charging floor is 17½ feet above the general level, while the floor on the pouring side is at yard level. The charging floor being placed so much higher than the floor of the casting side has the advantage of doing away entirely with any pits on the casting side, and also provides a cellar that is much cooler than that of the ordinary open-hearth plant.

The lean-to contains two narrow gage tracks, the charging floor having one broad gage track running its entire length and one narrow gage charging box car track. On the casting side there is one broad gage track for slag handling and one four-rail track for handling the spiegel. This four-rail track consists of one broad gage and one narrow gage on the same line. The casting side also contains the narrow gage pouring track along the pouring platforms, together with the customary turn-outs. The casting side also is fitted up with four pouring platforms, each of which is capable of serving two heats.

Charging Machines

In the charging building there are three floor-type charging machines, built by the Morgan Engineering Co., and two 75-ton Alliance Machine Co. ladle cranes, each having an auxiliary hoist of 25 tons capacity. On the casting side there are three 175-ton Alliance Machine ladle cranes, each having a 40-ton first auxiliary hoist, and 15-ton second auxiliary hoist. On the casting side also there is one 6-ton Whiting Foundry & Equipment Co. jib crane at each furnace, for handling the pouring spouts.

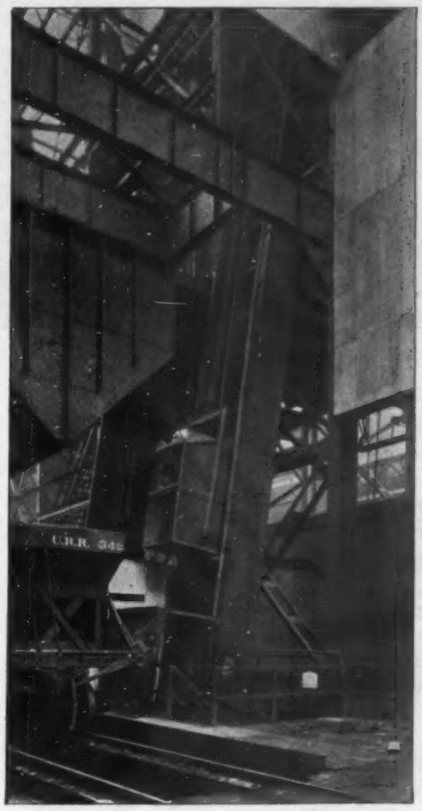


FIG. 4 — COAL HOIST OF GAS PRODUCER PLANT

Each furnace has a hearth 15 feet 3 inches x 39 feet 6 inches. The binding used is the Homestead type heavy slab, and the furnaces all are provided with Parks-Deuel removable ports. The raw materials for charging the furnaces are brought from the stock house, located on the north side of the furnace building. This stock house is 66 feet 3 inches wide by 1,036 feet 6 inches long, and contains one broad gage and two narrow gage tracks. Four 15-ton Morgan cranes are provided in this building, two being equipped with magnets and two with Williams grab buckets. The magnet cranes are used for handling the metal and scrap, and the bucket cranes for handling the ore and stone from the Suppes stock pit.

Use of Hot Metal

This plant will use a large percentage of hot metal which is delivered from the blast furnaces to the mixer over an elevated trestle, and from the mixer to the charging floor in the 35-ton ladle which is standard for the plant. This ladle is propelled by a Westinghouse electric locomotive. The steel ladle has a capacity of 110 gross tons, and the slag pot, which is stationed alongside the steel ladle, has a capacity of 315 cubic feet. These slag pots are handled to and from the cinder recovery yard on standard slag pot cars similar to the ordinary blast

furnace car, and are provided with an air-dump mechanism.

The re-carburizing of the rail steel is effected by the use of spiegeleisen. This spiegel will be handled from the spiegel cupola plant in a 20-ton ladle on a car propelled by a narrow gage locomotive, and the ladle will be lifted by the first auxiliary hoist on the pouring crane and dumped into the steel ladle as the heat is being tapped.

Mixer Building

The mixer building is located on the west end of the furnace house, in line with the charging floor, and is 84 feet wide by 120 feet long; its floor line is on the same level as that of the charging floor. The building is arranged for two 500-ton metal mixers, one of which is already installed, while provision has been made for the other. The mixer body is of the barrel type, mounted on heavy cast iron stands and rollers. The drive is effected by a screw through gearing from two 115-horsepower Westinghouse motors.

In the mixer building three broad gage tracks have been laid, one of which is a continuation of the broad gage track from the charging floor, the other two being receiving tracks for hot metal from the blast furnaces. This building also contains a narrow gage track in line with the charging box car track in front of the furnaces. The mixer was designed by E. T. Works and was built by the Pennsylvania Engineering Works. The mixer building also contains one 75-ton Alliance Machine ladle crane, with an auxiliary hoist of 25 tons capacity. This crane is used for handling the 35-ton hot metal ladle and for charging the mixer.

The gas producer plant consists of 29 Hughes mechanical producers, arranged in batteries of five for furnaces Nos. 1 and 2, and four producers, two to each furnace, for the remaining 12 furnaces, with provision for a fifth producer at each battery. Each battery is located in a separate producer building, 24 feet wide and 87 feet 6 inches long by 48 feet high. A continuous walk connects all the producer floors. The gas flues are all over-head, and are especially large. The Ahlen gas valve, 40-inch size, is used, together with 40-inch air valve of the mushroom and damper type. Fourteen steel stacks, each 8 feet in diameter and 180 feet high, are located on the north side of the furnace building, and a specially large burnout connection is provided between the gas flues and the stacks.

One of the special features of this plant is the electric valve operating mechanism for the gas combustion and air valves and dampers, which was designed by the Edgar Thomson works.

This reversing mechanism is so arranged that all valves and dampers are handled simultaneously under the control of the operator, who is required to move only a master controller in order to perform the whole operation of reversing the furnace.

The mechanism also is provided with means for adjusting the amount of opening of the different valves, and it is by this means that the quantity of gas to the furnace is regulated and the course of the products of combustion through the various chambers is controlled according to the requirements, thereby preventing excessive heating in any particular chamber.

Operating Machinery

The actuating machinery and the adjusting hand wheels are located on the charging floor in the lean-to building, and the levers and bell cranks connecting to valves are mounted on a platform below the charging floor.

FIG. 5—THE RAW MATERIAL STOCK HOUSE

The coal and ash-handling facilities for the gas producer plant are located between the fourth and fifth producer batteries, in a building 30 feet wide by 76 feet 6 inches long. The coal is brought in already crushed in broad gage hopper cars, and is delivered to the track hoppers. From the track hoppers it is delivered to the skip hoist, which in turn dumps the coal into the distributing bunker at the top of the coal house. From this distributing bunker the coal is delivered to the various producer bunkers by means of an electrically-operated larry car. The ashes from the producers are delivered by a larry car to a bunker alongside the skip pit. From this bunker they are delivered

to a skip car and conveyed to the top, being delivered by a chute to the ash bunker over the standard gage track, thence to the broad gage car for outside disposal.

Slag is delivered to the cinder recovery yard in slag pots and is dumped into a pit and crushed. After the cinder is crushed the metal is recovered by the use of a magnet, and the slag is loaded into standard railroad cars for outside disposal. This cinder recovery yard is 85 feet wide by 270 feet long, and is commanded by two Cleveland cranes, each having a 15-ton magnet hoist and a 15-ton grab bucket hoist. The yard is provided with two broad gage and two narrow gage tracks. The ingot molds also are handled in this yard.

The spiegel cupola house is located south of the mixer building at the west end of the pouring building, and occupies a space 34 feet by 82 feet 6 inches, with a height of 74 feet 3 inches, having a lean-to 19 feet 9 inches by 33 feet long. There are three 10-foot 3-inch diameter cupolas for spiegel arranged on a tapping floor 27 feet 6 inches above the ground level, with provision for one more. The pig iron and coke are delivered to the charging floor by two skip cars on a double skip hoist. The capacity per cupola charge is 5 to 6 tons, giving a total rated output for 24 hours of 600 tons.

The top of the cupola shell is 97 feet 3 inches above the yard level. The cupolas are tapped into a 150-ton mixer located on the north side of the cupola building. This 150-ton metal mixer is of special design. The shell body is 14 feet 9 inches in diameter and 20 feet 10.5 inches over all. This mixer is electrically-operated by two 75-horsepower Westinghouse motors, and was designed by the engineers of the Edgar Thomson works.

The Mixer

On the pouring side of this mixer is a broad gage hot metal track with a a 40-ton scale located under the mixer spout, and one narrow gage track at the other end. The mixer is enclosed in brick walls to protect it from the cupola dust.

The special blowers and hoisting machinery are arranged in separate buildings. The blower house adjoins the stock trestle, and the hoisting machinery is on a platform on two of the trestle bays, protected from dust by a steel frame construction, with corrugated iron sheeting.

Calcining Plant

The calcining plant is located on the north side of the stock house, and consists of a building 41 feet 3 inches wide by 180 feet long, with a lean-to 18 feet wide extending the entire length of the structure, and another lean-to on the opposite side extending two bays. There are three 10-foot diameter cupolas, and provision for two more. The raw material is brought from the yard on a track over a trestle to the elevated broad gage track inside the building. It is dumped from the car into the bins, from which a 10-ton Morgan crane lifts it with a 2-ton bucket to the cupolas. There are two conveyors; one brings the material from the cupolas to the crushers and grinding pans, and the other conveys the calcined material to the storage bins.

The structural work for all buildings was furnished by the American Bridge Co., and was erected by the Edgar Thomson works. In line with the policy of the Carnegie Steel Co., careful attention was given the question of safety throughout the designing and erection of the plant. Each of the cranes handling hot metal is provided with inter-locking gearing and with a complete extra set of ropes. The steel ladle has especially large diameter trunnions, which are located high above the ladle's center of gravity. The mixer building and the pouring platform in the casting building all are provided with refuge platforms. All of the narrow and standard gage railroad equipment is provided with M. C. B. standard couplers. In addition, all buildings and flues are provided with platforms and stairways, making easily and safely accessible all equipment requiring attention.

In addition to the reversing valve mechanism, which already has been described, a special feature of this plant is the absence of hydraulic

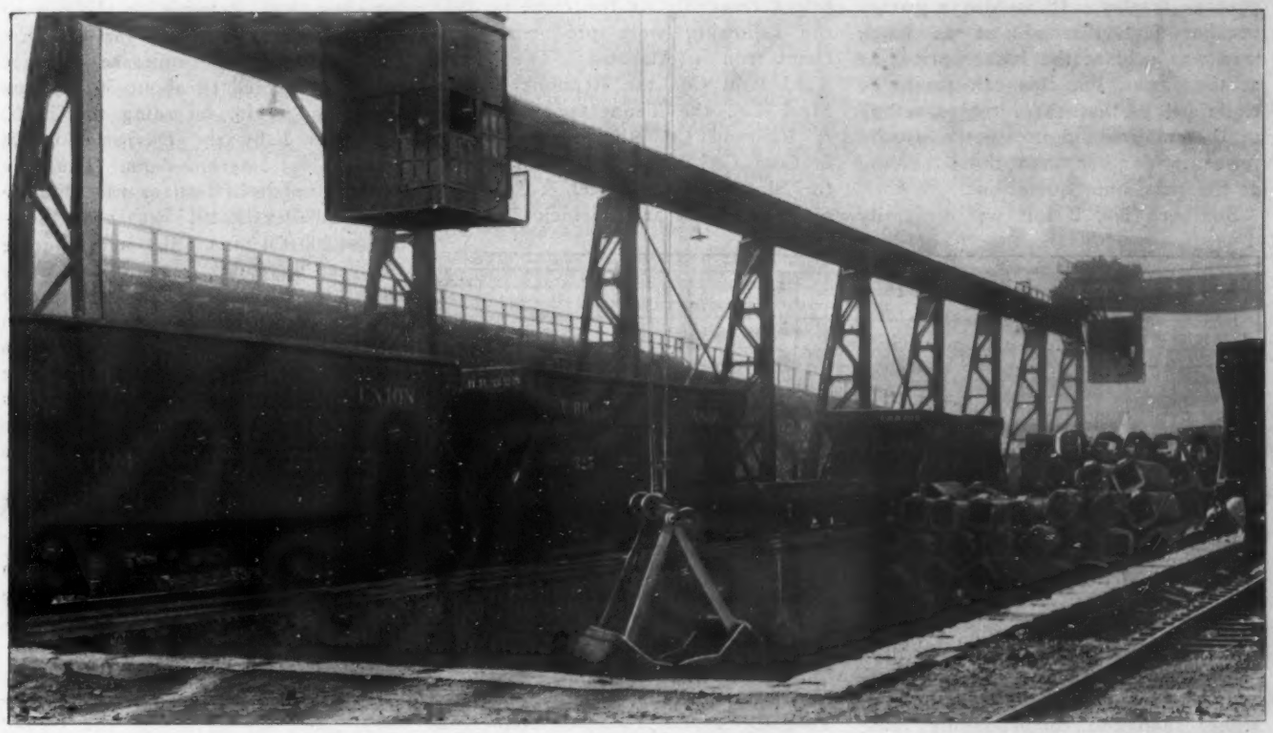


FIG. 6—THE SLAG RECOVERY PIT

power. Metal mixers, furnace doors, and various other machinery in which hydraulic power has commonly been used, are operated by electricity.

The first column of this open-hearth plant was erected Nov. 13, 1912, and the plant has been producing steel for nearly five months, thereby establishing a new record in construction work.

Steady Decline in Pig Iron Prices at Cincinnati

(Continued from page 32)

Birmingham, and likewise withdrew this price within a few days.

Several Alabama producers held rather firmly throughout the year at higher quotations than those that were generally given as the minimum by the other furnaces, and only once or twice during the entire twelve months were their lowest prices as far down the scale as those of the general market. It is also a rather peculiar fact that almost as much iron was sold at the higher prices as at the lower, but this can partly be explained in that the furnaces selling at the minimum figures were usually fewer in number than those holding at the maximum quotations.

Southern No. 2 soft was generally

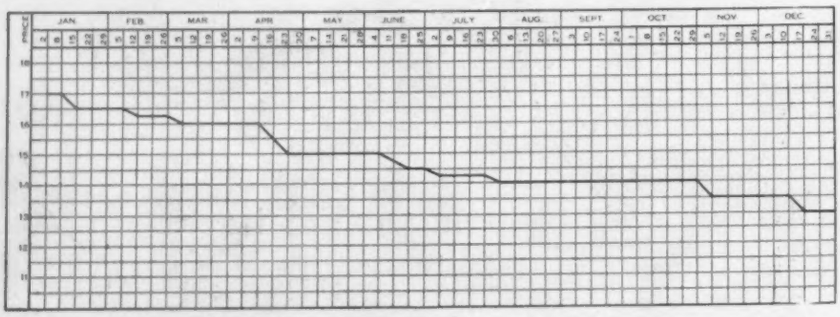


CHART SHOWING PRICES OF SOUTHERN OHIO FOUNDRY NO 2 AT IRONTON IN 1913.

a little stronger than No. 2 foundry, because of the scarcity of the former, and it was usually quoted a little higher than the corresponding foundry grades. Lower grade irons were also sometimes stronger in comparison with No. 2 foundry, principally because the former were not produced in as large quantities as the latter. It costs furnaces more to make lower grade irons in comparison with the prices obtained for them than it does to produce No. 2 foundry. Consequently, the general differential of 50 cents a ton between Nos. 3 and 4 foundry and mottled and gray forge was never recognized. The differentials that generally held throughout the year were 25 cents between Nos. 3 and 4 foundry, 25 cents between No. 4 foundry and gray forge, and 25 cents between the maximum prices only of gray forge and mottled. The minimum prices of these two latter grades were usually quoted on the same level. Southern basic iron fluctuated quite a little during the year, and at times was offered at a lower price than No. 2 foundry, principally during November. As a general rule, though, it is usually considered as being on the same level in regards prices as No. 2 foundry.

A large number of southern furnaces blew out during the year as prices receded. At the close of 1913, the following were producing merchant iron in Alabama: The Woodward Iron Co., the Republic Iron & Steel Co., the Tennessee Coal, Iron & Railroad Co., the Southern Iron & Coal Co., all at Birmingham, and the Sloss Sheffield Steel & Iron Co., at Birmingham and Sheffield, Ala. In Tennessee, the following merchant furnaces were in blast in December, 1913: Rockwood, at Rockwood; La Follette, at La Follette; Napier, at Napier; Cranberry, at Johnson City; the Cumberland furnace, at Cumberland, Tenn., operated by the Warner Iron Co., will blow in shortly after the first of the year.

Stocks Not Large

Southern furnaces did not pile a large amount of iron in their yards during 1913 when the extreme dullness that prevailed throughout the year is considered. On Dec. 1, 1912, 74,000 tons were piled in Alabama furnace yards in comparison with 230,000 tons on January 1, 1912, making a decline of 156,000 tons in Alabama alone during 1912. On Jan. 1, 1913, there were about 75,000 tons piled by Alabama furnaces, and on Dec. 1, 1913, this amount had been increased to approximately 140,000 or 150,000 tons, making an increase of about 75,000 tons during the year, or, in other words, the tonnage piled in Alabama furnace yards about doubled during 1913. These stocks increased very rapidly during the latter part of the year, averaging about 15,000 tons a month for the last three months. The rather heavy sales made during the last quarter of 1912 for first half delivery in 1913 kept these stocks fairly low for the first six months. In Tennessee, furnace stocks amounted to about 50,000 tons on Dec. 1, 1913, including the 25,000 tons stored by the Dayton Coal & Iron Co., at Dayton, Tenn. Thus the entire tonnage in furnace yards in the south on Dec. 1, 1913 was about 190,000 or 200,000 tons. Shipments during the year were not forced to be withheld by the furnaces as a general rule, as melters bought largely in small lots and when requirements actually demanded. This was true especially during the last six months when spot shipment sales were greatly in excess of those for future deliveries.

Time of Declines

There were 15 separate declines in southern No. 2 foundry iron during the year which are given as follows, together with the corresponding minimum prices at each decline, Birmingham basis: The second week in January, from $14 to $13.50; the second week in February, from $13.50 to $13.25; the third week in February, from $13.25 to $13; the first week in April, from $13 to $12.75; the second week in April, from $12.75 to $12.50; the third week in April, from $12.50 to $12; the second week in May from $12 to $11.75; the third week in May, from $11.75 to $11.50; the fourth week in May, from $11.50 to $11.25; the first week in June, from $11.25 to $11; the third week in June, from $11 to $10.75; the fourth week in June, from $10.75 to $10, which marks the low point of iron for the year; the first week in November, from $11 to $10.75; the second week in November, from $10.75 to $10.50, and the second week in December, from $11 to $10.50. There were four slight advances during the year, all of which were temporary.

They occurred in the latter part of June and the first part of July, from $10 to $10.25; the second week in July, from $10.25 to $10.50; the second week in August, from $10.50 to $11, and the last week in November, from $10.50 to $11.

The decline of southern Ohio iron was unlike that of southern iron in that the former dropped steadily and gradually during the entire year with no advances at any time. On Jan. 1, 1913, southern Ohio No. 2 foundry iron was generally quoted at $17, Ironton basis, for first half shipment. Late in December of the same year the prevailing price was $13, Ironton basis, for this same iron, with frequent rumors of offers made by furnaces at $12.50, Ironton, thus showing a drop of from $4 to $4.50 a ton during the year. The declines in southern Ohio iron and the corresponding minimum prices, Ironton basis, were as follows: The second week in January, from $17 to $16.50; the second week in February, from $16.50 to $16.25; the first week in March, from $16.25 to $16; the first week in April, from $16 to $15.50; the second week in April, from $15.50 to $15; the second week in June, from $15 to $14.75; the third week in June, from $14.75 to $14.50; the fourth week in June, from $14.50 to $14.25; the fourth week in July, from $14.25 to $14; the last week in October, from $14 to $13.50, and the second week in December, from $13.50 to $13.

Average Prices by Months of Southern No. 2 Foundry Iron.

	Average minimum prices, Cincinnati basis.	Average minimum prices, Birmingham basis.	Av. maximum and minimum prices, Cincinnati basis.	Average maximum and minimum prices Birmingham basis.
Jan.	$16.95	$13.70	$17.20	$13.95
Feb.	16.44	13.19	16.75	13.50
Mar.	16.25	13.00	16.50	13.25
Apr.	15.81	12.56	16.06	12.81
May	14.95	11.70	15.20	11.95
June	13.94	10.69	14.25	11.00
July	13.70	10.45	13.98	10.73
Aug.	14.13	10.88	14.19	10.94
Sept.	14.25	11.00	14.38	11.13
Oct.	14.25	11.00	14.50	11.25
Nov.	13.75	10.50	14.00	10.75
Dec.	14.00	10.75	14.13	10.88

Dull in Southern Ohio

Sales and inquiries of southern Ohio foundry iron were never heavy throughout the year, but a considerable tonnage was sold in small and fair-sized lots. Sales were usually made when declines took place, which were chiefly when some operator in the southern Ohio district would suddenly underbid the market and close several contracts before the other furnaces followed suit. Another custom that prevailed to a certain extent, and which was the cause in several instances of reducing prices, was that certain brokers would take contracts at 25 or 50 cents below furnace quotations upon the strength of their predictions that the market would go lower within a short time. As soon as these transactions became known among buyers, this lower price was correspondingly established, and the furnaces were accordingly forced to reduce to a lower figure in order to get any business. These brokers would then forward these orders previously taken, to the furnace operators, who would then accept them.

Southern Ohio basic iron could generally be had throughout the year at slightly lower prices than those pertaining to foundry iron, principally because the former usually sold in larger lots. The three large users of basic iron in this territory were the Andrews Steel Co., at Newport Ky., the American Rolling Mills Co., at Middletown, O., and the Portsmouth Steel Co., at Portsmouth, O., each of which bought several times during the year in quantities ranging from 10,000 tons to 30,000 and 40,000 tons. Southern Ohio furnaces took a fair part of this business, but some of the Newport and Middletown purchases went to Columbus, O., and Lake furnaces.

Lake furnaces did not invade this territory as frequently in 1913 as in 1912. This was because that in 1913 the price of northern basic iron was considerably lower than in 1912. Lake furnaces, therefore, were not anxious to sell into this territory with prices at such a low level, because the margin of profits that could be realized were more than counterbalanced by their large freight rates. In 1912, however, the higher prices of northern iron and the correspondingly higher profits more nearly counterbalanced the freight rates, with the result that a large tonnage of Lake iron was sold to melters in the Cincinnati territory.

At the close of 1913 the following furnaces were in blast in southern Ohio: Hanging Rock, at Hanging Rock; Union, at Ironton; Blanche, at Ironton; Ironton, at Ironton; Belfont, at Ironton, which blew in in December; Lawrence, at Culbertson; two Wellston, at Wellston; Star, at Jackson; Jisco, at Jackson, and Columbus, at Columbus, two stacks. There were also two stacks in operation at Ashland, Ky., and Globe, at Jackson, will blow in after the first of the year.

Stocks in furnace yards in southern Ohio were small at the end of 1913 in comparison with the number of furnaces in blast, which indicates good shipments on contracts throughout the year. This iron, also, was consumed and very little was piled in melters' yards, which was one of the redeeming features of the market, especially during the last six months. In December, 1913, there were about 55,000 tons of foundry and basic iron piled by southern Ohio furnaces, including that at Columbus, and about 10,000 or 15,000 tons of silvery iron piled at Jackson and Ashland, Ky.

The close of the year finds the Cincinnati market in a rather uncertain condition. Business is at a standstill, and even the extremely low prices that prevail in both southern and southern Ohio iron have not been inducive of a better demand. Melters as a general rule are taking inventories of stocks on hand and are, therefore, withholding from further buying until after the first of the year. Sales at the present time are mostly for immediate shipments, which indicates that users are covering only for prompt requirements. The situation is such that either an advance or a decline could occur after the first of January, depending entirely upon developments within the next eight or ten days. To predict the future of the market, therefore, would be merely speculation, but it is probable that not many more declines can take place before an advance will be realized, as it is generally considered that rock bottom in prices has about been reached.

Average Prices by Months of Southern Ohio No. 2 Foundry Iron.

	Average minimum prices, Cincinnati basis.	Average minimum prices, Ironton basis.	Average maximum and minimum prices, Cincinnati basis.	Average maximum and minimum prices, Ironton basis.
Jan.	$17.90	$16.70	$18.05	$16.85
Feb.	17.51	16.31	17.76	16.56
Mar.	17.20	16.00	17.45	16.25
Apr.	16.83	15.63	17.08	15.88
May	16.20	15.00	16.45	15.25
June	15.89	14.69	16.14	14.94
July	15.40	14.20	15.75	14.55
Aug.	15.20	14.00	15.45	14.25
Sept.	15.20	14.00	15.38	14.18
Oct.	15.20	14.00	15.20	14.00
Nov.	14.76	13.56	14.91	13.71
Dec.	14.70	13.50	14.70	13.50

The total value of the mineral production of Alabama, exclusive of the value of the pig iron, but including the value of the iron ores, was $30,641,983 in 1912 and $28,005,785 in 1911, approximately two-thirds of which is represented by the output of the coal mines and one-fifth by the output of iron ore. The iron ores of Alabama have the advantage of being near deposits of good coking coal and of the limestone requisite for fluxing, so that Birmingham, the Pittsburgh of the south, can manufacture pig iron cheaper than any other district of the world.

Average Monthly Prices of Iron and Steel Products, 1902-1913

Finished Products in Net Tons. Pig Iron and Billets in Gross Tons

1902

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
No. 2 Foundry Chicago	$15.80	16.75	18.62	19.75	21.75	22.50	23.40	24.66	27.15	27.15	26.90	25.40
Gray Forge Cincinnati	$13.75	13.75	15.25	16.00	17.05	18.93	20.00	21.50	21.50	20.60	18.87	18.00
Plates Chicago	$35.00	35.00	35.25	36.25	38.60	43.00	43.00	43.00	43.00	40.60	40.50	41.00
Billets (Bess.) Pittsburgh	$28.06	29.81	31.37	32.25	33.90	35.18	33.50	32.12	31.50	29.80	29.00	29.25
Bessemer Pig Pittsburgh	$16.70	16.93	17.56	18.37	20.95	21.25	22.00	21.75	21.75	21.95	22.25	22.12
Beams Pittsburgh	$32.00	32.00	34.00	37.00	40.00	45.00	45.00	47.00	45.00	43.00	42.00	40.00
Bar Iron Cleveland	$32.10	33.70	35.70	35.77	37.70	37.70	37.70	37.70	37.70	37.50	36.20	35.70
No. 2 Foundry Birmingham												

1903

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
No. 2 Foundry Chicago	$25.00	24.00	24.00	23.00	21.70	20.50	18.50	17.50	16.85	15.90	14.50	14.30
Gray Forge Cincinnati	$20.50	20.75	19.35	19.20	17.70	16.50	14.60	13.50	13.25	12.30	10.95	10.75
Plates Chicago	$35.00	37.00	38.00	40.00	37.75	35.00	35.00	35.00	35.00	35.00	35.00	35.00
Billets (Bess.) Pittsburgh	$29.75	30.00	30.25	31.00	30.50	29.50	27.50	27.00	27.00	26.50	23.50	23.00
Bessemer Pig Pittsburgh	$22.35	22.35	22.00	21.60	20.00	19.85	19.00	17.85	16.35	15.85	15.25	14.35
Beams Pittsburgh	$35.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00
Bar Iron Cleveland	$32.00	37.00	37.00	36.00	35.00	33.75	22.00	30.00	29.00	28.00	26.00	25.50
No. 2 Foundry Birmingham												

1904

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.
No. 2 Foundry Chicago	$14.10	13.75	13.55	14.00	13.80	13.40	13.30	13.35	13.40	13.70	15.60	16.60
Gray Forge Cincinnati	$11.00	11.00	11.25	11.75	11.25	10.75	10.75	11.00	11.00	11.75	14.25	15.00
Plates Chicago	$35.30	35.30	35.30	35.30	35.30	35.30	35.30	35.30	29.30	29.30	29.30	30.10
Billets (Bess.) Pittsburgh	$23.00	23.00	23.00	23.00	22.00	21.50	21.00	20.00	19.50	19.50	21.00	21.00
Bessemer Pig Pittsburgh	$13.60	13.35	13.85	14.10	13.60	12.60	12.50	12.65	12.75	13.35	15.25	16.60
Beams Pittsburgh	$32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	28.00	28.00	28.00	30.00
Bar Iron Cleveland	$25.00	26.00	27.00	29.00	29.00	28.00	28.00	25.00	25.00	27.00	28.00	32.00
No. 2 Foundry Birmingham	$ 9.75	9.50	9.70	10.00	9.65	9.15	9.15	9.50	9.50	10 65	12.75	13.05

1905

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
No. 2 Foundry Chicago	$17.50	17.50	17.50	17.50	17.25	16.60	16.15	16.35	16.50	17.55	18.90	19.50
Gray Forge Cincinnati	$15.25	15.20	15.00	15.20	14.81	13.35	12.28	13.00	13.00	13.88	15.35	15.75
Plates Chicago	$31.30	32.30	32.30	34.80	35.30	35.30	35.30	35.30	35.30	35.30	35.30	35.30
Billets (Bess.) Pittsburgh	$21.00	24.90	24.60	25.50	23.50	22.00	22.00	23.50	25.77	25.95	26.30	26.50
Bessemer Pig Pittsburgh	$16.85	16.45	16.35	16.30	16.20	15.65	15.00	15.40	15.90	16.50	17.70	18.10
Beams Pittsburgh	$30.00	31.00	32.00	32.00	32.00	32.00	32.00	32.00	34.00	34.00	34.00	34.00
Bar Iron Cleveland	$33.25	33.00	32.00	32.00	31.50	30.00	29.75	32.00	34.00	34.25	37.20	40.00
No. 2 Foundry Birmingham	$13.50	13 50	13 50	13.25	12.75	11.85	11.00	11.65	11.75	12.50	14.00	41.00

1906

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
No. 2 Foundry Chicago	$19.25	19.25	19.00	18.75	18.50	18.10	18.30	18.90	19.75	21.50	26.50	27.00
Gray Forge Cincinnati	$15.75	15.06	14.85	14.75	14.75	14.65	14.55	15.40	16.50	17.50	21.70	22 00
Plates Chicago	$35.30	35.30	35.30	35.30	35.30	35	30	35.30	35.30	35.30	35.30	37.30
Billets (Bess.) Pittsburgh	$27.00	27.50	27.65	27.75	27.00	26.25	27.00	28.00	28.50	28.50	29.00	29.75
Bessemer Pig Pittsburgh	$17.32	17.29	17.26	17.25	17.24	17.38	17.57	17.96	18.44	20.06	21.96	22.75
Beams Pittsburg	$34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
Bar Iron Cleveland	$38.00	35.50	34.00	33.00	32.00	32.00	32.00	33.50	34.00	36.00	39.00	39.00
No. 2 Foundry Birmingham	$14.00	14 00	13.70	13 65	13.75	13.50	13.00	14.15	16.00	17.15	21.25	22.00

1907

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
No. 2 Foundry Chicago	$26.00	26.50	26.75	27.50	27.40	26.50	25.40	24.50	23.60	22.60	20.60	19.00
Gray Forge Cincinnati	$22.60	22.50	22.70	21.50	21.90	21.35	20.55	19.95	18.85	18.45	17.35	15.50
Plates Chicago	$35.30	37.30	37.30	37.30	39.40	39.60	39.60	39.60	36.60	37.60	37.60	37.60
Billets (Bess.) Pittsburgh	$29.75	29.50	29.25	29.75	30.25	31.00	30.00	30.00	29.50	28.50	28.00	28.00
Bessemer Pig Pittsburgh	$22.92	22.78	22.85	22.16	24.10	24.10	23.30	22.90	22.90	22.80	20.60	19.90
Beams Pittsburgh	$34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.05	34.00
Bar Iron Cleveland	$39.00	36.50	36.00	36.00	35.00	34.00	34.00	33.00	33.00	32.50	31.00	31.00
No. 2 Foundry Birmingham	$23.00	23.00	22.75	22.00	21.40	21.25	20.50	19.80	18.12	17.65	16.00	14.91

1908

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
No. 2 Foundry Chicago	$18.24	17.87	17.42	17.21	17.00	17.31	17.00	17.00	16.75	16.50	16.75	17.35
Gray Forge Cincinnati	$14.45	14.06	13.63	13.60	13.50	13.75	13.70	14.00	14.25	14.25	14 25	14 75
Plates Chicago	$37.60	37.60	37.60	37.60	37.60	36.60	35.60	35.60	35.60	35.60	35 60	35.60
Billets (Bess.) Pittsburgh	$28.00	28.00	28.00	28.00	28.00	26.50	25.00	25.00	25.00	25.00	25.00	25 00
Bessemer Pig Pittsburgh	$19.00	17.90	17.86	17.49	16.92	16.90	16.73	16.11	15.90	15.48	16-74	17.40
Beams Pittsburgh	$34.00	34.00	34.00	34.00	34.00	33 00	32.00	32 00	32.00	32.00	32.00	32.00
Bar Iron Cleveland	$28.80	27.00	28.00	28.40	30.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00
No. 2 Foundry Birmingham	$12.80	12.50	12.12	11.90	11.50	12.00	11.60	12.06	12.50	12.50	12.50	13 00

1909

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
No. 2 Foundry Chicago	$17.44	16.75	16.50	16.46	16.21	16.41	16.90	17.37	18.20	18.87	19.00	19 00
Gray Forge Cincinnati	$14.75	14.62	13.50	13.25	13.31	13.50	13.95	14 62	15.25	16.62	16.75	16.75
Plates Chicago	$35.60	34.10	29.60	28.60	28.95	28.60	30.60	31.60	32 80	33.60	35.60	35.60
Billets (Bess.) Pittsburgh	$25.00	23.50	23.00	22.00	22.50	23.00	24.00	25.00	26 00	26 50	27 50	27 50
Bessemer Pig Pittsburgh	$17.34	16.78	16.34	15.80	15 48	16 13	16 37	17.13	18.33	19.68	19.90	19.90
Beams Pittsburgh	$32.00	29.00	26.00	24.00	25.00	26 00	27.00	28 00	30.00	30.00	31.00	32 00
Bar Iron Cleveland	$29.00	28.75	26.20	25.25	25.00	26.20	29.25	30 00	30 00	30.00	32.00	32 00
No. 2 Foundry Birmingham	$13.00	12.70	11.75	11.00	11·00	11.31	12 30	13 00	14 00	14.50	14 50	14 00

1910

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
No. 2 Foundry Chicago	$19.00	18.75	18.25	17.00	16.75	16 50	16 50	16.50	16.50	16.00	16.00	16.00
Gray Forge Cincinnati	$16.50	16.38	15.75	14.88	14.56	14.35	14.12	13.75	13.75	13.75	13.75	13.75
Plates Chicago	$35.60	35.60	34.60	33.60	33 60	32.60	31.60	31.60	31.60	31.60	30.60	30.60
Billets (Bess.) Pittsburgh	$27.87	27.50	27.50	27.00	26.12	25.50	25.00	25.00	24.50	23.38	23.00	23 00
Bessemer Pig Pittsburgh	$19.90	19.42	18.90	18.15	17.08	16.73	16.40	16.21	15.90	15.90	15.90	15.90
Beams Pittsburgh	$31.00	31.00	30.40	30.00	30 00	29.20	28.20	28.00	28.00	28.00	28.00	28.00
Bar Iron Cleveland	$33.00	33.00	33.00	32.50	31.00	30.10	28.00	28.00	28.00	28.00	27.80	27.00
No. 2 Foundry Birmingham	$14.00	13.88	13.00	12.12	11.81	11.60	11.38	11.00	11.00	11.00	11.00	11.00

1911

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
No. 2 Foundry Chicago	$15.00	15.00	15.00	15.00	15.00	15.00	15.00	14.50	14.50	14.50	14.00	14.00
Gray Forge Cincinnati	$13 35	13.25	13.15	13.05	12.90	12.50	12.05	12 05	12.05	12.00	12.00	12.00
Plates Chicago	$31.60	31.60	31.60	30.60	30.60	30.60	30.60	29.60	29.60	26.60	25.00	25.00
Billets (Bess.) Pittsburgh	$23.00	23.00	23.00	23.00	23.00	21.00	21.00	21.00	21.00	21.00	20.00	19.70
Bessemer Pig Pittsburgh	$15.90	15.90	15.90	15 90	15.90	15.90	15.90	15.90	15.90	15.39	15.10	15.15
Beams Pittsburgh	$28.00	28.00	28 00	28.00	28.00	27.00	27.00	27.00	26.40	24.00	22.60	23.25
Bar Iron Cleveland	$27.00	27.00	27.00	26.75	26.20	24.75	24.00	25.00	24.75	24.00	24.00	24.00
No. 2 Foundry Birmingham	$11.00	11.00	11.00	11.00	10.75	10.25	10.00	10.05	10.10	10.00	9.75	10.00

1912

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
No. 2 Foundry Chicago	$14.00	14.00	14.00	14.25	14.50	14.50	14.62	15.30	16.37	17.30	17.87	18.00
Gray Forge Cincinnati	$12.50	12.50	12.50	12.50	12.85	13.00	13.50	13.90	14.75	15.70	16.18	15.75
Plates Chicago	$26.00	25.76	25.90	27.55	28.60	28.60	29.60	30.40	31.35	32.60	33.60	33.60
Billets (Bess.) Pittsburgh	$20.00	20.00	19.88	20.00	21.10	21.88	22.25	22.40	23.75	25.70	26.75	27.00
Bessemer Pig Pittsburgh	$15.15	15.00	15.02	15.15	15.15	15.15	15.15	15.43	15.93	17.75	18.05	18.15
Beams Pittsburgh	$23.00	23.00	23.00	23.40	25.00	25.00	26.00	27.40	28.60	28.60	29.00	29.00
Bar Iron Cleveland	$24.00	23.50	23.50	24.00	24.40	25.25	27.00	27.25	29.00	30.20	31.00	31.00
No. 2 Foundry Birmingham	$10.00	10.00	10.06	10.50	10.95	11.00	11.25	11.65	12.50	13.45	13.75	13.50

1913

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
No. 2 Foundry Chicago	$18.00	18.00	17.62	17.25	16.70	16.12	15.20	15.00	15.00	15.00	15.00	14.50
Gray Forge Cincinnati	$15.75	15.25	15.25	14.25	13.50	12.75	12.75	12.75	13.25	13.25	13.00	13.25
Plates Chicago	$33.60	33.60	33.60	33.60	32.80	32.60	2.60	32.60	31.60	30.80	28.85	27.60
Billets (Bess.) Pittsburgh	$28.20	28.87	29.00	29.00	27.37	26.50	26.50	26.12	25.00	23.00	20.87	20.00
Bessemer Pig Pittsburgh	$18.15	18.15	18.15	17.92	17.90	17.26	16.65	16.52	16.65	16.60	16.09	15.90
Beams Pittsburgh	$29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	28.25	27.40	27.00	26.00
Bar Iron Cleveland	$33.00	33.00	33.00	33.00	32.50	32.00	31.20	29.25	28.25	27.40	27.00	26.00
No. 2 Foundry Birmingham	$13.70	13.50	13.00	12.50	11.75	10.60	10.50	11.00	11.00	11.00	10.75	11.00

Charts based on above prices are published as a supplement of today's issue.